SIEMENS

POWERMOBIL

SP

System Manual

Trouble-Shooting-Guide

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Required documents

- POWERMOBIL circuit diagram
- Circuit diagram for monitor X2080 (if present)
- POWERMOBIL System Manual
- For the laser targeting device option, if present: Setting Instructions / Laser targeting device RXR2-130.032.01...

Required tools, measurement and auxiliary devices

NOTE

All tools, measurement and auxiliary devices with the exception of those marked "*", are listed along with their specifications in the STC (Service Tools Catalogue).

- DMM (e.g. "Fluke 8060 A", part no. 97 02 101)
- Oscilloscope > 50 MHz (e.g. Fluke Combi Scope PM 3390A, part no. 99 00 861)
- Dose measurement instrument (e.g. PTW-DIADOS, part no. 97 17 612)
- Protective conductor meter (e.g. BENDER UNIMET 1100 ST, part no. 51 38 727)
- Service-PC with WINDOWS 95 operating system*
- Service software (see POWERMOBIL System Manual)*
- Connection cable, Service-PC - POWERMOBIL (e.g. part no. 99 00 440)
- 1 set of resolution tests (e.g. part no. 28 71 820)
- 1 set of radiation filters (e.g. part no. 97 98 596)
- Center cross (e.g. part no. 96 60 051)
- Heat conducting paste WPS (e.g. part no. 20 48 650)
- Special purpose oil (Optimol Optipit) part no. 55 07 525
- Special purpose oil (Slic Pac PTFE) part no. 55 07 517
- Standard service equipment*
- 1 set Allen keys*
- 200 N spring scale (e.g. part no. 44 15 113)
- Torque wrench 20 Nm to 100 Nm (e.g. part no. 80 86 159)
- Torque wrench 3 Nm to 20 Nm (e.g. part no. 34 24 553)
- A 30 mm socket key (is required for adjusting the brake)*

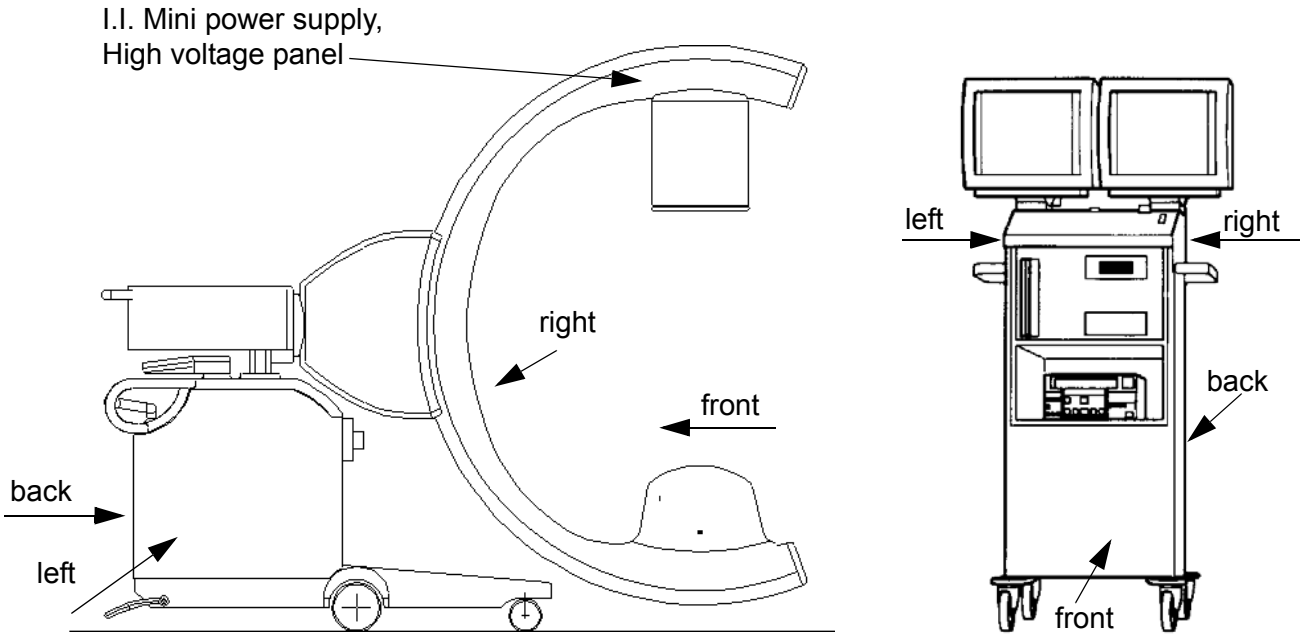

Fig. 1

Information regarding this document

These service instructions will assist you in adjusting the POWERMOBIL for routine operation. Not every adjustment is required each time the system is serviced.

Position designations

The designations used in these instructions left, right, front and back are explained in Fig. 1.

Safety information

⚠WARNING

Danger of possibly fatal physical injury and property damage!
Observe

- **the product-specific safety information in these instructions,**
- **the general safety information in instructions TD00-000.860.01... and**
- **the general safety information according to ARTD Part 2.**

Noncompliance can lead to death, physical injury or property damage.

⚠WARNING

Electrical voltage!
Noncompliance can lead to death, physical injury or property damage.

Once the system covers have been removed, voltage-conducting parts become contactable. To prevent danger, always disconnect the system from the line voltage before removing the covers. To do this, pull the power plug or switch the system power supply off and secure the power switch against accidental activation.

If an uninterruptible power supply (UPS) is installed in the system, the power supply of the UPS must be switched free of voltage in addition or the voltage output plug must be pulled out.

If service in connection with electrical voltage is required, the generator safety information in instructions TD00-000.860.01... must be observed.

⚠WARNING

Electrical voltage!
Noncompliance can lead to death, physical injury or property damage.

After service is performed on the primary circuit of the ON/OFF assembly (e.g. replacement of the ON/OFF assembly or any of its components) the equivalent leakage current must be measured and recorded (see system manual or logbook).

⚠WARNING

Electrical voltage!
Noncompliance can lead to death, physical injury or property damage.

After completing service work and refitting all covers, a protective ground wire test must be performed according to ARTD-002.731.17.. . The protective ground wire resistance must not exceed 0.2 ohms.

⚠WARNING

Electrical voltage!
Noncompliance can lead to death, physical injury or property damage.

The electrolytic capacitor batteries of the generator and on the generator boards remain charged even after the system has been switched off for a longer period of time. These electrolytic capacitors must be discharged before beginning work on the electrolytic capacitor batteries or on the generator. To do this, set switch D21.S2 to the UZ_OFF position and wait until LEDs D21.X22 and D21.X23 extinguish. Then check the voltage between measuring points X109.UZ_IST(ACT) and X109.ANA_GND.
This voltage must equal < 0.2V (corresponding to Uz < 20V).

⚠WARNING

Danger of infection with pathogens!
Noncompliance can lead to death or physical injury.

Since this product has been approved for use in operating rooms, it may be contaminated with infectious blood or other excreta. Avoid any skin contact with blood or other excreta!
The preventive measures against infectious diseases specified in ARTD-002.731.37... must be strictly observed at all times!

⚠WARNING

X-ray radiation!
Noncompliance can lead to illnesses, irreversible damage to body cells and the genotype, severe injuries and even death.

In work on the system in which radiation must be released, the radiation protection directives and the rules for radiation protection according to ARTD 02.771.02 must be complied with.

Note:

- **Use available radiation protection devices.**
- **Wear radiation protection clothing (lead apron).**
- **Keep your distance from the radiation source as large as possible.**
- **Release radiation only if necessary.**
- **Set the radiation activity as low as possible. (low kV and mA values, short radiation time)**
- **Release radiation for as short a time as possible.**

Checks in which radiation must be released are identified by the radiation warning symbol.

⚠WARNING

Risk of injuries on mechanical parts!

If not observed, slight to medium injuries, especially to the hands, can occur.

The C-arm of the system is manufactured from carbon fiber composite material (CFK). In the case of damage to the carbon fiber structure, for example caused by collision or by cutting or scraping tools, individual carbon fibers or carbon fiber bundles can stand out and on contact cause injuries to the skin or penetrate into the tissue of the hand.

Before starting work on the C-arm, make sure that there is no damage to the carbon fiber structures (visual inspection).

If smaller superficial damage is detectable in the painted area or in the area of the running surface edges of the C-arm, wear working gloves and remove any projecting carbon fibers. Then carefully rub the damaged places flat with fine emery cloth and close the damaged surface with paint. A spray paint in the color of the C-arm can be used for this purpose (See Service Tool Catalogue).

Remove any carbon fibers lying in the C-arm profile with a damp sponge or cloth.

If greater damage to the carbon fiber structure indicating persistent or large-scale destruction of the carbon fiber structure (e.g. crack formation or flaked off places in the running surfaces with torn carbon fibers) can be detected, then replace the C-arm.

⚠CAUTION

Electrostatic voltage!
Noncompliance can lead to property damage.

ESD protection guidelines must be observed when performing service.

⚠CAUTION

Risk of being burnt by hot parts or components!
Noncompliance can lead to light or medium burns, especially of the hands.

Once the covers have been removed, parts or components (e.g. power components, heat sinks, solenoid brakes) become contactable which may exhibit temperatures of > 50° Celsius when in operation. To prevent burns, switch off the system power supply before contacting any parts or components and let the system cool off for at least 5 minutes before resuming work.

⚠CAUTION

Danger of injury when dismantling / assembling mechanical parts! Non-compliance can lead to minor up to moderately severe injuries, especially to your hands!

If parts that are under mechanical stress have to be dismantled or assembled, as for example the cover over the horizontal carriage of the basic unit, inattention can cause injuries due to crushing, cutting or grazing the skin, especially on the hands.

Perform the corresponding work with special care and attentiveness.

Wear working gloves if necessary.

⚠CAUTION

Danger of injury on mechanical parts!
Non-compliance can lead to minor up to moderately severe injuries, especially to your hands!

With covers removed, you can come into contact with parts such as flat plugs, threaded bolts, cut off cable ties or edges of components on which, in the case of inattention, injuries can arise due to crushing, cutting or grazing the skin, especially on the hands.

Perform the corresponding work with special care and attentiveness.

Wear working gloves if necessary.

Notes on the protective conductor resistance test

Observe the instructions in the safety rules for installation and repair (ARTD-002.731.17 ...).

The protective conductor resistance must be measured after every intervention in the system.

Documentation of the measured values is normally required only during periodical safety checks.

If parts / components decisively influencing the protective conductor resistance are replaced (e.g. replacement of the mains cable, replacement of the power-up module, replacement of multi-core connection cables, which also create the protective conductor connection between parts of the system (e.g. monitor cable or C-arm cable)), or if protective conductor connections have been repaired, then the protective conductor resistance must be measured, documented and assessed.

The measurement must be made according to DIN VDE 0751, Part 1 (see ARTD Part 2). In this case the protective conductor resistance to all conductive touchable parts of the system must be measured.

Make sure that control cables or data cables between the components of the system do not imitate any protective conductor connection.

During the measurement the power cable and additional connection cables which also create the protective conductor connection between parts of the system (e.g. monitor cable between basic unit and monitor trolley) must be moved section by section to detect broken conductors.

The protective conductor resistance must not exceed 0.2 Ohms.

The values must be recorded and assessed as repeat measurements in the protective conductor resistance record stating the measuring points.

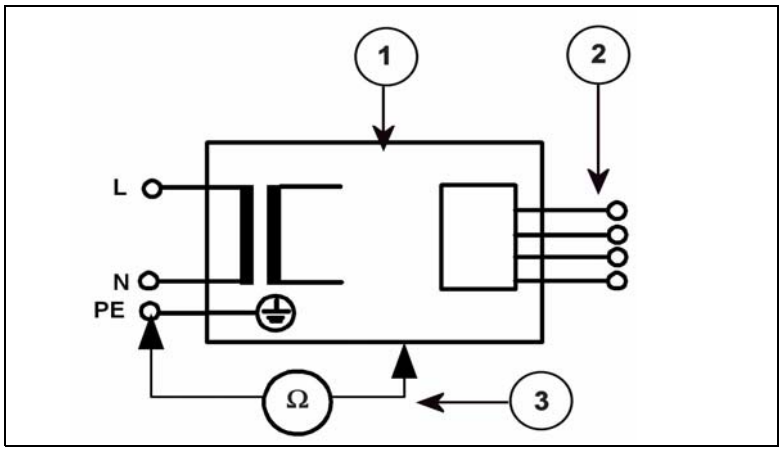

Fig. 2 Measuring circuit for measuring the protective ground wire resistance for units that are disconnected from power, in compliance with DIN VDE 0751-1:2001-10, Fig. C2.
1 = System
2 = Applied part (if present)
3 = Measuring arrangement (integrated in measuring instrument)

NOTE

Evaluate the results by comparing the first measured value with the corresponding values of preceding maintenance procedures or safety checks.
A sudden or unexpected increase of the measured values may indicate a safety-relevant defect - even if the limit value of 0.2 Ohms is not exceeded (protective ground wire or contacts).

Notes on device leakage current measurement

Observe the instructions in the safety rules for installation and repair (ARTD-002.731.17 ...)..

⚠WARNING

Electric voltage!
Noncompliance can lead to severe injuries and even death.

The device leakage current measurements may be performed on systems of protection class I only after the protective conductor test has been passed.

First measured value

In most cases, the first measured value has already been determined and documented in the device leakage current record.

The measurement was performed with the recorded line voltage, line frequency and with the recorded measuring equipment.

If the local line voltage or line frequency deviates from the line voltage or line frequency documented in the record (e.g. change of location with different local line voltage / line frequency), or if no documented measured values are available, then perform the device leakage current measurement. Mark the old values as invalid. Cross out the values, enter the comment "invalid values" and confirm with name, date and signature.

Adjust/program the system to the local line voltage / line frequency before the measurement.

Measurement

Perform the measurement according to DIN VDE 0751, Part 1 (see ARTD-002.731.17....), and record the determined value as the first measured value.

Measurement of the device leakage current according to the residual current procedure (measuring arrangement according to Fig. 2) must be given preference, since no danger for the person performing the measurement and other persons arises during the measurement.
However, please note the minimum resolution of the leakage current measuring instrument and any additional manufacturer's data restricting the use of the measuring instrument.

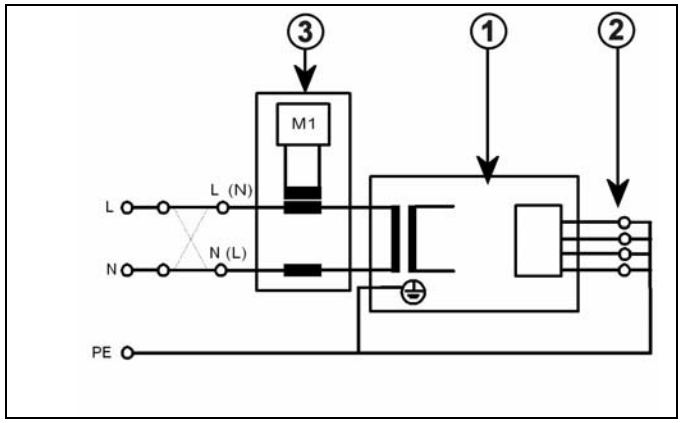

Fig. 3 Measurement circuit for measuring the device leakage current using the residual current procedure compliant with DIN VDE 0751-1:2001-10, Fig C6 for protection class I.
1 = System
2 = Application part (if present)
3 = Measuring arrangement (integrated in the measuring instrument)

If the direct measurement of the device leakage current is used (measuring arrangement according to Fig. 3), then the system must be set up insulated during the measurement and must not be touched during the measurement.

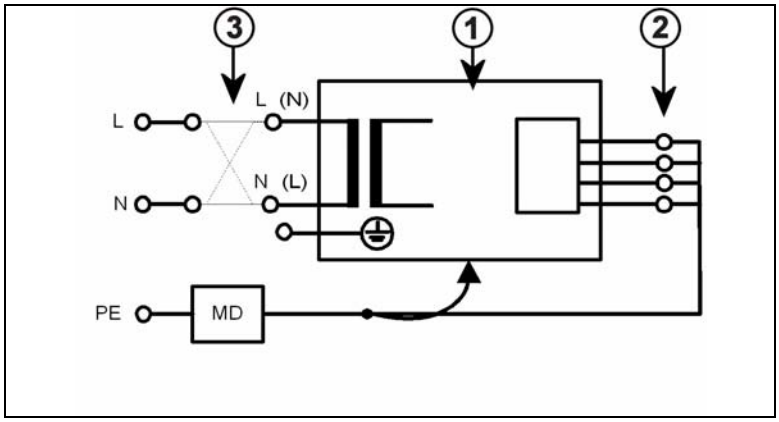

Fig. 4 Measurement circuit for direct device leakage current measuremen compliant with DIN VDE 0751-1:2001-10, Fig C5 for protective class I.
1 = System
2 = Application part (if present)
3 = Measuring arrangement (integrated in the measuring instrument)

⚠WARNING

Electric voltage!
Noncompliance can lead to severe injuries and even death.
In the direct measurement of the device leakage current (measuring arrangement according to Fig. 2) the protective conductor is no longer connected with the protective conductor of the power socket. In the first case of fault, voltages up to the level of the line voltage can therefore occur on the protective conductor / housing of the system.
Housing parts of the system must not be touched during the measurement.
Third-person access to the system must be prevented.

The system must be switched on during the measurement. Measuring instruments with automated measuring sequences must therefore be set to manual measurement.

Enter the highest value as first measured value in the device leakage current record.

This value must not exceed the permissible leakage current values according to DIN VDE 0751-1:2001-10, Table F.1, line "Device leakage current for devices according to remarks 1 and 3", of 2.5 mA.

Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, then correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. Document this in addition.

Document the measuring procedure (differential measurement or direct measurement) and the measuring instrument used (designation and serial number).

File the record sheet in the system folder or logbook with the existing records.

Repeat measurement

When service or repair work is performed on the primary power supply circuit (e.g. repairs to the power-on circuit or replacement of the line filter), the device leakage current test must be repeated.

The same measuring conditions as in the first measurement apply.

Record and assess the highest value determined in the repeat measurement in the existing device leakage current record.

This value must not exceed the permissible leakage current values according to DIN VDE 0751-1:2001-10, Table F.1, line "Device leakage current for devices according to remarks 1 and 3", of 2.5 mA.

Measure and record the current line voltage. If the measured line voltage deviates from the nominal voltage, then correct the measured value to the value corresponding to a measurement at the nominal value of the line voltage. Document this in addition.

Document the measuring procedure (differential measurement or direct measurement) and the measuring instrument used (designation and serial number).

.

NOTE	**Evaluate the results by comparing the first measured value with the corresponding values of preceding maintenance procedures or safety checks.** **A sudden or unexpected increase of the measured values may indicate that a fault has occurred in the primary circuit of the power supply (damaged insulation, damage caused by water ingress or humidity, defective interference suppressor, etc.) - even if the limit value of 2.5 mA is not exceeded.**

Covers

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Disconnect the line voltage plug prior to removing covers.

Basic unit

Removing the cover

- Apply the foot brake.
- Remove the screws from the cover.
- Pull the cover away to the back.
- Unscrew the protective conductor from the cover.
- Pull the cover completely off and remove it.

Installing the cover

- Reattach the protective conductor to the back cover.
- Push the cover forward.
- Replace the cover and tighten the screws.

Cover over the horizontal carriage

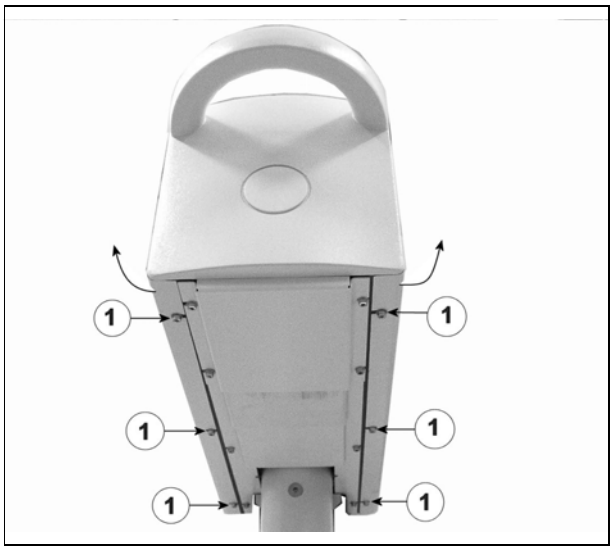

Fig. 5

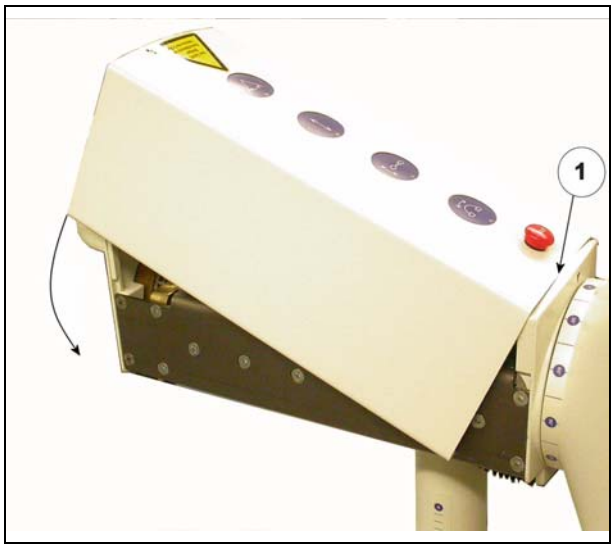

Fig. 6

Removing the cover

- Loosen the 6 mounting screws (1/Fig. 2).

⚠CAUTION

Danger of injury when dismantling / assembling mechanical parts! Non-compliance can lead to minor up to moderately severe injuries, especially to the hands!

The cover over the horizontal carriage is bent U-shaped and must be pulled on the side to the outside when it is removed.
The cover is then under mechanical stress.

We recommend that you wear light working gloves to avoid injuries.

- Expand the cover at the rear end in the direction of the arrow (see Fig. 2) and remove it downwards.
- If needed, disconnect the protective ground wire, the cable of the keypad (brake buttons) and the cable of the emergency stop button.

Attaching the cover

- Re-fasten or connect the protective ground wire, the cable of the keypad (brake buttons) and the cable of the emergency stop button.

⚠CAUTION

Danger of injury when dismantling / assembling mechanical parts! Non-compliance can lead to minor up to moderately severe injuries, especially to the hands!

When the cover is attached and pressed down, it is under mechanical stress and snaps into place over the bottom edge of the horizontal carriage.
Expand the cover at the rear end (see Fig. 2) so far that, as shown in Fig. 3, it lies obliquely over the horizontal carriage in the edge, 1/Fig. 3.

Press on the top surface of the cover, without grasping the sheet metal edges, until this slides over the lower edge of the horizontal carriage.

- Expand the cover at the rear end (see Fig. 2) so far that, as shown in Fig. 3 it lies obliquely over the horizontal carriage in the edge 1/Fig. 3.
- Press on the top surface of the cover, without grasping the sheet metal edges, until this slides over the lower edge of the horizontal slide. Here, make sure that the cover does not slide out from the edge (1 / Fig. 3).
- Check the operation of the emergency stop button and of the brake buttons.
- Fasten the cover with the 6 Allen screws (1/ Fig. 2).

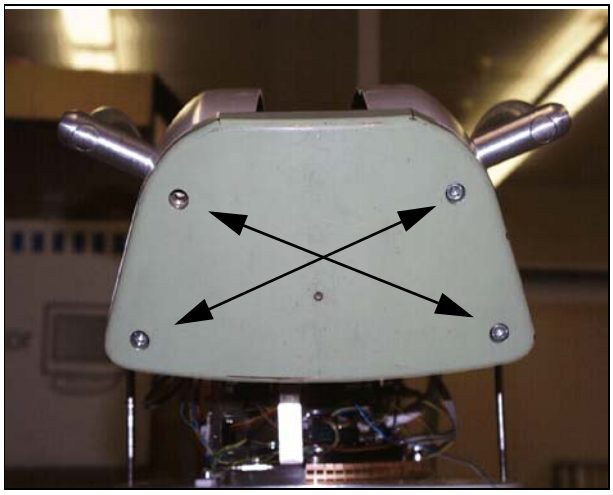

Fig. 7

Installing/removing the C-arm covers

⚠WARNING	**Risk of injuries on mechanical parts!** **If not observed, slight to medium injuries, especially to the hands, can occur.** **Observe the notes concerning the C-arm carbon fiber structure.**

⚠CAUTION	**Risk of injury!** **Noncompliance can lead to light or medium injuries and/or property damage.** **The C-arm cover contains counterbalance weights and weighs > 10 kg.** **Hold the covers firmly when installing or removing them.** **Before the C-arm cover will be loosened, the C-arm must be moved to its middle orbital position.** **If the C-arm covers are loosened, the C-arm may not be moved to its orbital end positions (I.I. in the orbital end position).**

- Remove the 4 fastening screws (Fig. 2). Hold the covers firmly while removing them.
- Install them following the same procedure in the reverse order.

Monitor trolley

Removing the covers

- Remove the upper back cover plate of the log book compartment.
- Remove the protective conductor.
- Remove the lateral Allen screws from the lower back cover.
- Remove the protective conductor from the cover.

Installing the covers

- Begin with the lower back cover.

- Reattach the protective conductor for the lower cover.
- Install the cover and tighten the screws.
- Reattach the protective conductor for the log book compartment.
- Install the cover and tighten the screws.

Installing/removing the covers at the C-arm mounting

- Remove the cover screws and remove both covers towards the side.
- After completing the procedure, reinstall both covers in the reverse order.

Telescope cover underneath the horizontal carriage

- Remove the four lower screws.
- Slightly loosen the two front screws and remove the telescoping cover towards the bottom.

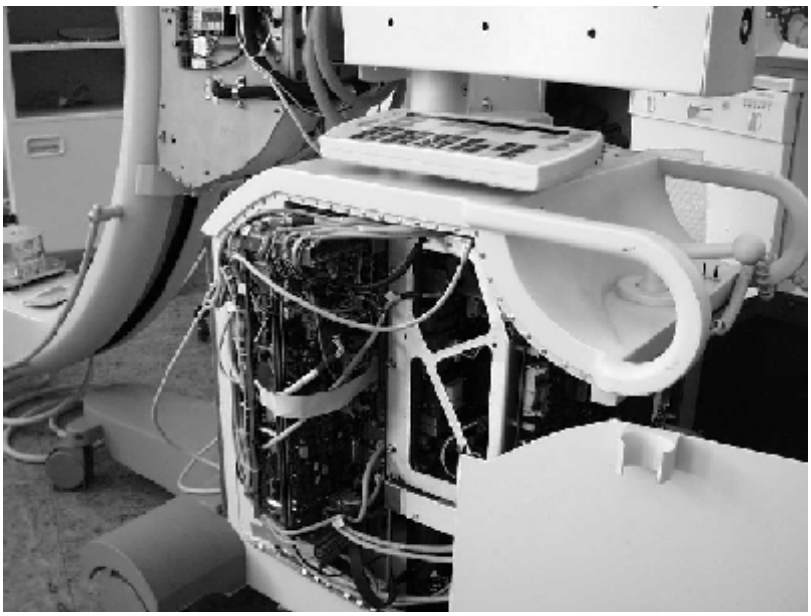

Fig. 8

Service position of the board slide-in module in the unit

- Removing and attaching the covers (see "Covers", Chapter 1).
- The board slide-in module can be withdrawn after loosening the screws (Fig. 3).

Fig. 9

I.I. service position

⚠WARNING

Risk of injuries on mechanical parts!
If not observed, slight to medium injuries, especially to the hands, can occur.

Observe the notes concerning the C-arm carbon fiber structure.

Moving the I.I. into the service position

- Take the service screws from the kit supplied.
- Move the C-arm into the vertical position, with the I.I. below and the POWERPHOS above.
- Remove both attachment screws for the I.I. and replace them with the service screws.
- Insert the service screws at least 5 turns into the threaded holes of the I.I.
- Hold the I.I. firmly and turn the C-arm so that the I.I. is above and the POWERPHOS is below (angulation).
- Hold the I.I. firmly and carefully remove it from the C-arm. Be careful not to damage the cables.

Installing the I.I.

- Move the C-arm into the vertical position, with the I.I. below, the POWERPHOS above.
- Holding the I.I. firmly, carefully lift it up. Be careful not to damage the cables.
- Holding the I.I. firmly, move the C-arm so that the POWERPHOS is above and the I.I. is below (angulation).
- Carefully insert the I.I. into the C-arm. When doing this, be careful not to damage the cables.
- Remove the two service screws again from the threaded holes of the I.I. and reinstall the I.I. with the two attachment screws.

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Disconnect the POWERMOBIL power plug.

- Open the back cover of the monitor trolley.
- Measure the on-site line voltage and line frequency.
- Adjust transformer T1 to the required line voltage and line frequency. Refer to the label on the switch-on assembly.
- Adjust transformer T2 to the required line voltage and line frequency. Refer to the label on the switch-on assembly.
- Check fuses F1 and F2 to see as to whether they correspond with the values on the label of the switch-on assembly and replace them, if necessary.
- Mark the correct line voltage and line frequency on the line voltage label at the back of the monitor trolley.

Checking the line voltages on the monitor trolley

- Plug X10 for the basic unit must be disconnected.
- The monitor, memory device and other devices, if present, such as multiformat camera, video printer or video recorder must be disconnected from the line voltage supply.
- Check the secondary voltages for line voltage transformer T1 according to table 1.

From test point	to test point	Voltage	Comment
Transformer T1.31	Transformer T1.32	190 V ~ to 205 V ~	not adjustable
Transformer T1.31	Transformer T1.33	230 V ~ to 246 V ~	not adjustable
Power cable Memoskop, N	Power cable Memoskop, L	230 V ~ to 246 V ~	not adjustable
Power cable Monitor 1, N	Power cable Monitor 1, L	230 V ~ to 246 V ~	not adjustable
Option: Power cable Monitor 2, N	Power cable Monitor 2, L	230 V ~ to 246 V ~	not adjustable
Option: Power cable Multispot, N	Power cable Multispot, L	230 V ~ to 246 V ~	if Multispot present, not adjustable
Option: Power cable Video printer, N	Power cable Video printer, L	230 V ~ to 246 V ~	if Video printer present, not adjustable
Option: Power cable Video recorder, N	Power cable Video recorder, L	230 V ~ to 246 V ~	if Video recorder present, not adjustable
Option Power cable optical video separation, N	Power cable optical video separation, L	230 V ~ to 246 V ~	if optical video separation present, not adjustable

Tab. 1

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Low voltages

Check the operating voltages of the POWERMOBIL according to Table 1.

From test point	To test point	Voltage	Adjuster
D1.X37 (0V)	D1.X30 (+5 V)	+5.1 V to 5.2 V	M14. +5 V/Adj.
D1.X39 (0V)	D1.X32 (+15 V)	+14.9 V to 15.1 V	M14. +15 V/Adj.
D1.X39 (0V)	D1.X33 (-15 V)	- 14.8 V to -15.2 V	M14. -15 V/Adj.
D30.X1.8 (0V)	D30.X1.9 (+24 V)	+24.0 V to 29.6 V	not adjustable
D30.X21.1 (0V)	D30.X21.10 (+24 V)	+22.8 V to +29.5 V	not adjustable
D30.X20.1 (0V)	D30.X20.3 (+27 V)	+27.3 V to +27.8 V	D30 R115
M13.S- (0V)	M13.S+ (+13 V)	+13.1 V to 13.3 V	M13.TR1

Tab. 1

Image intensifier voltages

Take the voltages E1 / E2 / E3 and A from the test protocol of the image intensifier and check or adjust them at the test points of the control unit listed in Table 2.

Voltage	Test point	Ground point (0V)	Potentiometer for full format	Potentiometer for zoom format	Voltage divider ratios
E1	UE1	⊥	P10	P11	1:1
E2	UE2	⊥	P6	P7	1:1
E3	UI 15	⊥	P2	P3	1:10000
30 kV, anode	UI 30	⊥	P1	P1	1:10000

Tab. 2

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Loading the operating software

- Connect the service PC to the serial service interface on POWERMOBIL.
- Insert the "Parameter" disk in drive A.
- Start the service program.
- Select the Download menu, select the relevant file (Host, Gen....) and start Download.
- After successfully downloading, wait for the system to boot (1 minute).
- The POWERMOBIL is operational.

NOTE	**If you cannot run Download (e.g. power failure during Download):** - Switch the POWERMOBIL off and back on - Restart Download

Backing up the system parameters

NOTE	**After changing settings / parameters, back these up on the parameter disk.** **Note that the data are stored correctly only after ending the service program** **Therefore always exit the service program with "Logoff" and "Quit".**

Prerequisite:

The service PC is already connected, the service program is already started.

- Select the "Data" menu.
- Select the "Backup" submenu.
- Click the "Parameter" check box.
- If required select the back-up of further data by selecting the corresponding check box.
- Click the "Backup" button. Wait until the data are backed up temporarily on disk.
- Then back to the main menu.
- Select the "System" menu.
- Select the "Logoff" submenu. Wait until the data are stored on disk.
- You can now exit the service program by selecting the "System" and "Quit" menus.

Reading and storing the load counter data

NOTE

Before the replacement of the POWERPHOS, all load counter values have to be stored on disk. After storing the load counter values, the load counter has to be reset. All values are set to 0. After the replacement and all adjustments, send back the disk with the defective POWERPHOS for repair.

The procedure is divided in 4 steps:

- Store the actual load counter values on disk.
- Release the resetting of the load counters
- Resetting the load counter values to 0.
- Return the defective POWERPHOS, including the load counter data disk.

Store the actual load counter values

- Connect the service PC to the serial interface of the unit.
- Start the service program.
- Select the "Diagnostics / Monitoring" menu.
- Select "LOAD COUNTERS" in the "Group 1:" combo box.
- Click on "Update Start" and wait until the actual values are displayed.
- Click on "Update Stop".
- Click on the "Save" button.
- Change the data disk of the service program in drive A against an formatted empty one.
- Select the drive A for storage.
- For the file name, enter the actual date, the part no. and the serial no. of the POWERPHOS.

  Example:

The actual date is:	08-22-1999
Use the date format DD-MM-YY:	22-08-99
The POWERPHOS part no. is:	55 73 501
The POWERPHOS serial no. is:	01234
Enter the file name:	22-08-99_5573501_01234.his

- Store the file on disk.
- After storage, change the disk in drive A against the previous used data disk of the service program.
- Close the Monitoring window by clicking on the "Cancel" button.

Release the resetting of the load counter values

- Select the "Adjustment / Parameters..." menu.
- Select "SETTINGS FOR SERVICE PC" in the "Parameter Groups:" combo box.
- Click on the "Get from Unit" button.
- Select the parameter "ENABLE RESET TUBE VALUES".
- In the "Value / Actual" field, select "YES".
- Click on the "Set Value" button.
- Click on the "Put to Unit" button.
- Answer the query with "YES" and wait until the unit has rebooted.
- Close the Parameters window by clicking on the "Cancel" button.

Reset the load counters

- Select the "Adjustment / Calibrations..." menu.
- Answer the query with "YES".
- Select "RESET TUBE VALUES" in the "Function Groups:" combo box.
- Select "LOAD COUNTER" and click on "Execute".
- The load counters are set to 0.
- Close the Status window by clicking on the "OK" button.
- Answer the query "Do you want to reset the Unit" with "Yes".

Return the defective POWERPHOS incl. load counter data disk

- Mark the load counter data disk label with:
  the actual date
  the system part no (POWERMOBIL)
  the system serial number
  the POWERPHOS part number and
  the POWERPHOS serial number.
- Add the disk to the defective POWERPHOS and send all back for repair together with the completed tube questionnaire.

Storage of the error log as ASCII file

- In the case of storing the error log, using the backup function of the service program, the error log will be stored as binary file and can't be read with a word editor.
  For easier evaluation of the error log, it is also possible to store it as ASCII file.
  For easier service support from the USC or HSC, please send the error log as an ASCII file.

NOTE	**The parameter diskette must be in drive A, before the start of the service program and during the service work. Without parameter diskette in drive A, the short error messages will not be stored in the error log file and the text "no error text available" is stored behind the error codes.**

Prerequisites:
The service PC is already connected, the service program is already started.

- Select the menu "Diagnostics...."
- Select the menu "Error log".
- Click on the button "Get from unit". Wait till the error log is transferred to the service PC.
- Click on the button "Export to file".
- Select your hardisk drive for storage of the file.
- For the file name, please enter the actual date, the part number and the serial number of the unit as described in the example.

Example:	The actual date is (DD-MM-YY):	29-03-01
	The unit part no. Is:	28 30 011
	The unit serial no. IS:	01234
	Enter the file name:	22-03-01_28 30 011_01234.txt

- Store the file on the hardisk drive of the service PC, to a path of your choice.
- Exit the service program.
- Copy the previous stored file to a formatted, empty one.

Generator adjustment

NOTE

The mAs counter adjustment must be performed immediately after the generator adjustment.

- Cover the radiation exit window with a lead cover or a folded lead apron.

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Use radiation protection.
Wear a lead apron when making adjustments! Maintain a safe distance!

- Select the DIAGNOSTICS - MONITORING menu.
- Select "GENERATOR ADJUSTMENT" in the "Group 1" combo box.
- Click on "Update Start".

  ➪ The collimator closes automatically.

- After about 5 seconds, press the radiation release button on the hand control or the POWERMOBIL fluoroscopy footswitch.

NOTE

When the generator adjustment begins, continue pressing the radiation release button until the "Stop monitoring" message appears in the "ACTIONS" line. If the radiation release button is released too soon, the entire generator adjustment will have to be repeated.

Exception: Briefly releasing the radiation release button (less than 30 seconds) is permitted during the warm-up phase of the POWERPHOS (the message "Warm-up" appears in the "Status" line on the service PC). The generator adjustment will continue if the radiation release button is pressed again within 30 seconds.

  ➪ After approximately 8 minutes, the message "Learning pushfactor" appears.

  ➪ A maximum of 15 exposures is automatically released.

  ➪ When the generator adjustment has been successfully completed, the message "Learning done" appears in the status display.

  ➪ The message "Stop monitoring" then appears in the status line.

- Click on "Update Stop".

Concluding tasks

- Perform the mAs counter adjustment.
- Switch the POWERMOBIL off and then on again.

mAs counter adjustment

NOTE	**The mAs counter adjustment must also be performed after the generator adjustment.**

- Cover the radiation exit window with a lead cover or a folded lead apron.

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Use radiation protection.** **Wear a lead apron when making adjustments! Maintain a safe distance!**

- Select the DIAGNOSTICS - MONITORING menu.
- Select "MAS COUNTER ADJUSTMENT" in the "Group 1" combo box.
- Click on "Update Start".

  ➪ The collimator closes automatically.

- After about 5 seconds, press the radiation release button on the hand control or the POWERMOBIL fluoroscopy footswitch.

NOTE	**When the mAs-counter adjustment begins, continue pressing the radiation release button until the message "Stop monitoring" appears in the "ACTIONS" line. If the radiation release button is released too soon, the mAs-counter adjustment will have to be repeated.**

  ➪ A maximum of 9 exposures is automatically released.

  ➪ When the mAs-counter adjustment has been successfully completed, the message "Stop monitoring" appears in the status line.

- Click on "Update Stop".

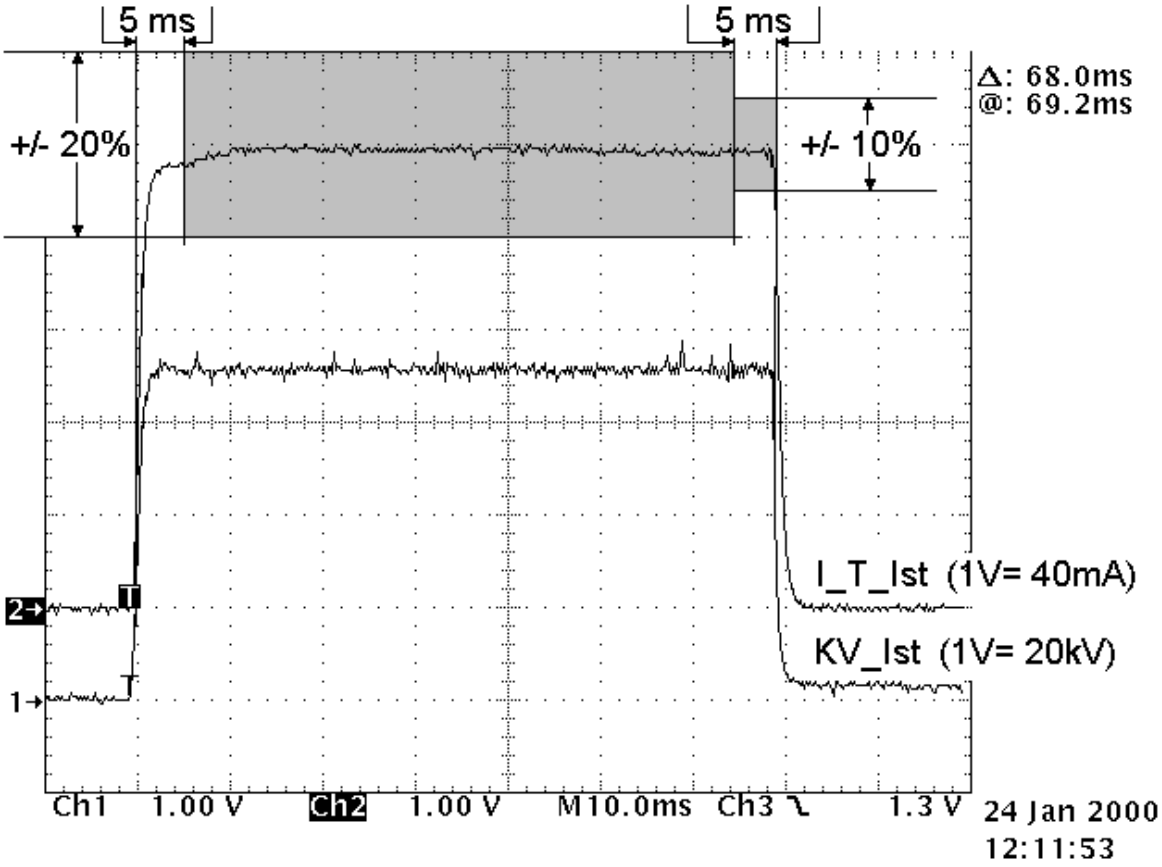
Concluding tasks

- If no other adjustments or settings need to be made, save the learned data to a disk (Data menu - Backup on the Service PC).
- Perform the checking of the generator adjustment, see next page.

Checking the generator adjustment

- Select the DR operating mode
- Temporarily set K-factor to K = 1 (= EB).
- Select the HC 2 or HC 3 characteristic curve.
- Select the ->0<- key on the basic unit control console.
- Select kV Stop.
- Set 75 kV ± 1 kV with the kV+ / kV- keys.
- These default settings give a 200 mA pulsed current.
- Connect a storage oscilloscope to the test points for "kV_Ist" (D21.X118. kV_IST) and "mA_IST" (D21.X118. I_T_IST). Ground: D21.X118.ANA_GND.
- Store and evaluate the oscillogram:
  Tolerances for the mA curve

  - 5 ms after pulse start to 5ms before pulse end: ± 20 %
  - during the last 5 ms before pulse end ± 10 %



- If the tube current exceeds the specified tolerances, the generator setup and the mAs counter adjustment must be repeated.

Dose rate adjustment

NOTE

There are 2 methods to set the dose rates.

- **Automatic dose rate adjustment: with this method the dose rate needs only to be set for the DR operating mode and dose rate level HIGH in the full format. All other dose rate levels and the necessary TV iris diaphragm values are automatically calculated and stored.**
  After the automatic dose rate adjustment, perform "Calibrating the TV iris diaphragm for automatic iris diaphragm regulation (AIR)", Chapter 5.
  Then all dose rate values must be checked according to "Checking the set dose or dose rate", Chapter 5. If the dose or dose rate values deviate from the nominal values by more than the permissible tolerance, the dose rate adjustment must be repeated according to "Manual dose rate adjustment" of Chapter 5.
- **Manual dose rate adjustment: with this method about 40 dose rate values must be set for the different operating modes.**
  Use this method only if automatic dose rate adjustment is not successful.

Automatic dose rate adjustment

Preparing the service PC

- Switch the system on.
- Connect the service PC to the serial interface of the system.
- Start the service program, the parameter disk must be inserted in drive A.
- Select the "Diagnostics..." menu.
- Select the "Monitoring..." menu.
- Select the "DOSERATE ADJUSTMENT" menu in the Combo box "Group 1".
- Select "Update Start".

The following messages are displayed on the service PC:

AUTO REGULATION	displays the current status during the adjustment. (active / not active / not ready / done)
ADJUSTMENT	displays the regulation operating mode. (Generator / Camera iris / Stop)
ACTUAL MODE	displays the operating mode currently selected. (FL/ PFL/DR/EB/SUB)
II. ZOOM STATUS	displays the current I.I. format. (Full format / Zoom format)
DOSE ADJ. NOMINAL VAL	displays the nominal values for the dose rate. (see Menu Adjustments... - Parameter - DOSE ADJ. (respective operating mode) - NOMINAL VALUES)
DOSE LEVEL	displays the dose rate level selected. (Low / Mid / High)
TV IRIS ACTUAL POSITION	displays the current position of the TV iris.

NOTE

After clicking on "Update Start" on the service PC, the primary up-to-date operating statuses (see above) will be displayed during the dose rate adjustment.

Key assignment on the control console during dose rate adjustment

During the dose rate adjustment, certain keys are assigned special functions.

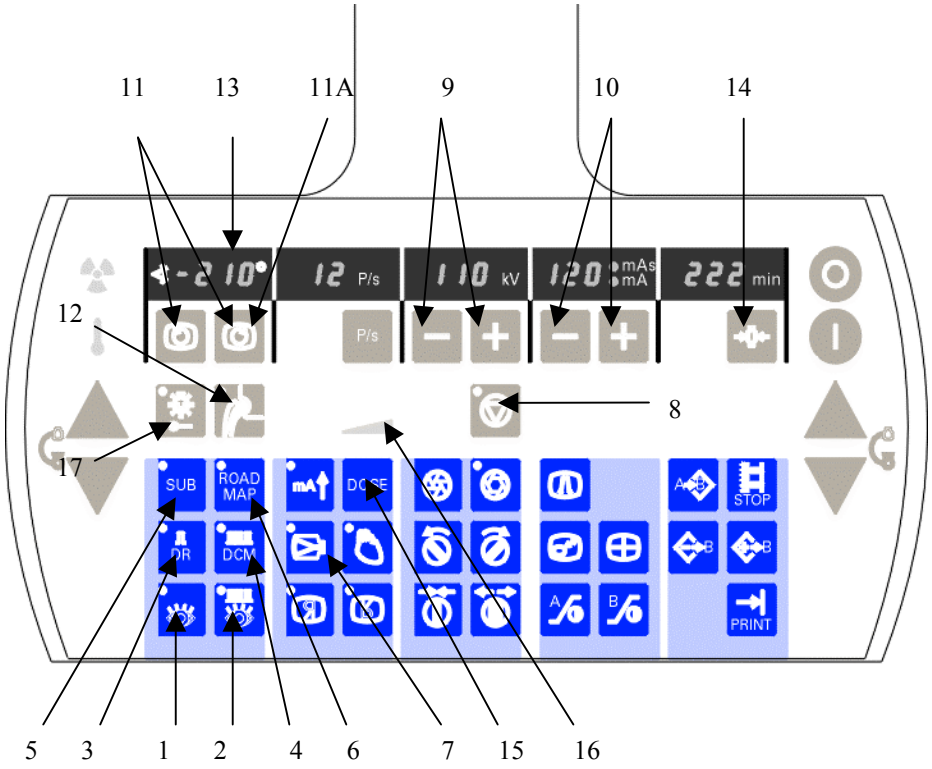


Fig. 1

1 Selects FL operating mode (Fluoroscopy)
2 Selects PFL operating mode (Pulsed Fluoroscopy)
3 Selects DR operating mode (Digital Radiography)
4 Selects DCM operating mode (Digital Cine Mode)
5 Selects DSA operating mode (Subtraction)
6 Selects EB operating mode (EB = Single Image Mode)
7 I.I. full format (LED off) / Zoom (LED on)
8 kV Stop (LED on), 75 kV curve
9 mA coarse adjustment
10 mA fine adjustment
11 TV Iris adjustment
11A Opens TV Iris
12 TV Iris adjustment fine (LED on, adjust with key 11) or coarse (LED off, adjust with key 11)
13 Displays actual brightness - nominal brightness deviation
14 Saves TV Iris position
15 Selects the dose rate level LOW MID and HIGH (see also 16).
16 LED display for dose rate levels (1 LED = LOW; 2 LEDs = MID; 3 LEDs = HIGH)
17 Starts and saves the automatic dose rate adjustment.

Dose rate value to be set for the automatic dose rate adjustment

NOTE

The dose rate value to be set is not the same as the dose rate value or dose values / pulse at normal operation. Please refer to Table 4 "Checking the dose or dose rate" in this Chapter for this value.

NOTE

The dose rate value given in Table 1 must be set.
For all other dose rate values the associated TV iris diaphragm values are automatically calculated and stored.

NOTE

If a dose measuring device with a solid-state detector is used, take care that the solid-state detector lies outside the dominant of the dose rate control.

The dominant has a diameter of approx. 6 cm in relation to the monitor screen.

The dose measuring chamber correction factor is not to be taken into account in this case. The dose rates then result from: [Dose rate at I.I. input (nGy/s)] * [Grid correction factor].

23 cm I.I.

Operating mode	I.I. format	Dose rate level	Dose rate at the I.I. input (nGy/s)	Dose rate at the I.I. input * Grid correction factor * Dose measuring chamber correction factor (nGy/s)
DR	**Full format**	**HIGH**	**740**	**1176**

Tab. 1

Tolerance for dose rate: ± 5%.

Correction factors:

DALI and NOMEX dose measuring device, large measuring chamber: 1.06
23 cm (9") I.I.: Grid correction factor: 1.5

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Use radiation protection. Wear a lead apron when making the adjustments! Keep the fluoro time as short as possible! Maintain a safe distance!

Measuring setup

- The grid should be attached to the I.I.
- Center the dose measuring chamber on the I.I. input screen and attach it.
- Attach 0.9 mm CU to the radiation exit window of POWERPHOS.

NOTE	**If the dose rate value to be set cannot be attained, adjust the pre-filtration accordingly.**

NOTE	**To prevent inaccuracies, the measuring chamber of the dose rate measuring device must be fully irradiated during setting.**

Setting the dose rate

- "Dose rate adjustment" must be started.
- "Update Start" must be selected.
- Select the DR operating mode. (LED in the key (3/Fig. 1) lights up).
- Select full format. (LED in the key (7/Fig. 1) is off).
- Press one of the keys (10/Fig. 1). The 75 kV curve is selected. 75 kV are shown in the display.
- Select kV stop. (LED in the key (8/Fig. 1) lights up).
- Select dose rate level HIGH (all three LEDs in the display (16/Fig. 1) light up).

- Turn the radiation on (fluoroscopy hand switch or fluoroscopy foot switch).
- Set the dose rate with the kV+ and kV- keys according to the table (coarse adjustment).
- The value can be adjusted with the mA+ and mA- keys in 1/16 exposure points.
- Then set the Brightness Nom. - Brightness Act. deviation with the camera rotation keys (11/Fig. 1), shown in the display (13/Fig. 1) to 0 ± 3.
- When the key (12/Fig. 1) is selected (LED in the key lights up), the TV iris will move more slowly (fine adjustment).
- Press the key (14/Fig. 1). An acoustic Signal sounds. The current TV iris diaphragm position will be stored.
- Then press the key (17/Fig. 1). An acoustic signal sounds (Multiple "beep"). All TV iris diaphragm values will automatically be calculated and stored.
- Do not exit the dose rate setting window yet! First calibrate the TV iris diaphragm for automatic iris diaphragm regulation!
- Then perform "Checking the set dose or dose rate", Chapter 5.
- If one or several dose or dose rate values show deviations, the setting must be repeated according to "Manual dose rate adjustment".

Manual dose rate adjustment

Preparation of the service PC

- Switch the POWERMOBIL on.
- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program. The parameter disk must be inserted into disk drive A.
- Select the "Diagnostics..." menu.
- Select the "Monitoring..." menu.
- Select the "DOSERATE ADJUSTMENT" menu in the "Group 1" combo box.
- Select "Update Start".

The following messages are displayed on the service PC:

AUTO REGULATION	displays the current status during the adjustment. (active / not active / not ready / done)
ADJUSTMENT	displays the regulation operating mode. (Generator / Camera iris / Stop)
ACTUAL MODE	displays the operating mode currently selected. (FL/ PFL/DR/EB/SUB)
II. ZOOM STATUS	displays the current I.I. format. (Full format / Zoom format)
DOSE ADJ. NOMINAL VAL	displays the nominal values for the dose rate. (see Menu Adjustments... - Parameter - DOSE ADJ. (respective operating mode) - NOMINAL VALUES)
DOSE LEVEL	displays the dose rate level selected. (Low / Mid / High)
TV IRIS ACTUAL POSITION	displays the current position of the TV iris.

NOTE

After clicking on "Update Start" on the service PC, the primary up-to-date operating statuses (see above) will be displayed during the dose rate adjustment.

Key assignment on the control console during dose rate adjustment

During the dose rate adjustment, certain keys are assigned special functions.

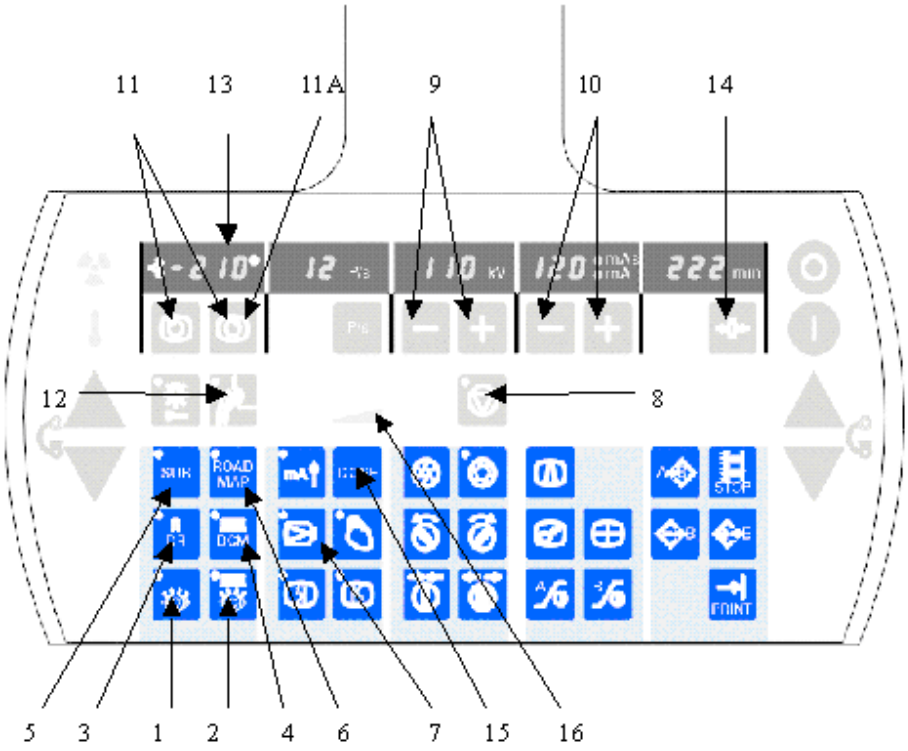


Fig. 2

1	Selects FL operating mode (Fluoroscopy)
2	Selects PFL operating mode (Pulsed Fluoroscopy)
3	Selects DR operating mode (Digital Radiography)
4	Selects DCM operating mode (Digital Cine Mode)
5	Selects DSA operating mode (Subtraction)
6	Selects EB operating mode (EB = Single Image Mode)
7	I.I. full format (LED off) / Zoom (LED on)
8	kV Stop (LED on), 75 kV curve
9	mA coarse adjustment
10	mA fine adjustment
11	TV Iris adjustment
11A	Opens TV Iris
12	TV Iris adjustment fine (LED on, adjust with key 11) or coarse (LED off, adjust with key 11)
13	Displays actual brightness - nominal brightness deviation
14	Saves TV Iris position
15	Selects the dose rate level LOW MID and HIGH (see also 16).
16	LED display for dose rate levels (1 LED = LOW; 2 LEDs = MID; 3 LEDs = HIGH)

Dose rate values to be set

NOTICE

The dose rate values to be set for pulsed operating modes are not the same as the dose rate values or dose values/pulse output by these modes. Please refer to the Operating Instructions for these values.

NOTICE

Table 2 shows the dose rate values to be set in the order of the operating modes.

Table 3 shows a useful arrangement for setting the dose rate values (from low to high values).

The dose rate values printed in bold in Table 3 must be set.

All other identical dose rate values will automatically be transferred.

This means that the same dose rate value only needs to be set once for different operating modes.

NOTICE

During the dose rate setting, write down the generated TV iris position values.
If the setting from low dose rate values to high dose rate values is performed (sequence as per Table 3), ensure that the current TV iris diaphragm value is not higher than or equal to the previously set TV iris diaphragm value.
Otherwise the setting must be repeated.
The error message 7500/7501 will be displayed in the event of an incorrect setting after next boot up of the unit.

If only individual new dose rate values are set, the new TV-iris positions have to be checked for plausibility.
To ensure this, check the parameters (Menu "Adjustments..." / Parameters..." / "DOSE ADJ. II. FULL FORMAT" and "DOSE ADJ. II. ZOOM FORMAT") after setting the TV iris diaphragm value.
For every next higher dose rate level, the corresponding TV iris diaphragm value must decrease.

23 cm I.I., in the order of the operating modes

Operating mode	I.I. format	Dose rate level	Dose rate at the I.I. input (nGy/s)	Dose rate at the I.I.input * Grid correction factor * Dose measuring chamber correction factor (nGy/s)
FL	Full format	LOW	110	175
FL	Full format	MID	185	295
FL	Full format	HIGH	370	588
PFL	Full format	LOW	220	350
PFL	Full format	MID	370	588
PFL	Full format	HIGH	740	1176
DR	Full format	MID	370	588
DR	Full format	HIGH	740	1176
EB	Full format	MID	1480	2353
EB	Full format	HIGH	2960	4706
DCM	Full format	LOW	770	1224
DCM	Full format	MID	1295	2059
DCM	Full format	HIGH	2590	4118
DSA	Full format	MID	370	588
DSA	Full format	HIGH	740	1176
FL	Zoom format	LOW	160	254
FL	Zoom format	MID	260	413
FL	Zoom format	HIGH	520	827
PFL	Zoom format	LOW	310	493
PFL	Zoom format	MID	520	827
PFL	Zoom format	HIGH	1050	1669
DR	Zoom format	MID	520	827
DR	Zoom format	HIGH	1050	1669
EB	Zoom format	MID	2100	3339
EB	Zoom format	HIGH	4200	6678
DCM	Zoom format	LOW	1100	1749
DCM	Zoom format	MID	1850	2941

Operating mode	I.I. format	Dose rate level	Dose rate at the I.I. input (nGy/s)	Dose rate at the I.I.input * Grid correction factor * Dose measuring chamber correction factor (nGy/s)
DCM	Zoom format	HIGH	3650	5803
DSA	Zoom format	MID	520	827
DSA	Zoom format	HIGH	1050	1669

Table 2

Setting values:
Tolerances during the dose rate setting: $\pm$ 5%.
The positive tolerance range should be utilized preferably for the setting.

23 cm I.I., in the order of the dose rate

Operating mode	I.I. format	Dose rate level	Dose rate at the I.I. input (nGy/s)	Dose rate at the I.I.input * Grid correction factor * Dose measuring chamber correction factor (nGy/s)
FL	**Full format**	**LOW**	**110**	**175**
FL	**Full format**	**MID**	**185**	**295**
PFL	**Full format**	**LOW**	**220**	**350**
DR	**Full format**	**MID**	**370**	**588**
DSA	**Full format**	MID	370	588
FL	**Full format**	HIGH	370	588
PFL	**Full format**	MID	370	588
DR	**Full format**	**HIGH**	**740**	**1176**
DSA	**Full format**	HIGH	740	1176
PFL	**Full format**	HIGH	740	1176
DCM	**Full format**	**LOW**	**770**	**1224**
DCM	**Full format**	**MID**	**1295**	**2059**
EB	**Full format**	**MID**	**1480**	**2353**
DCM	**Full format**	**HIGH**	**2590**	**4118**
EB	**Full format**	**HIGH**	**2960**	**4706**
FL	**Zoom format**	**LOW**	**1) 160**	**1) 254**
FL	**Zoom format**	**MID**	**260**	**413**
PFL	**Zoom format**	**LOW**	**310**	**493**
DR	**Zoom format**	**MID**	**520**	**827**
DSA	Zoom format	MID	520	827
FL	Zoom format	HIGH	520	827
PFL	Zoom format	MID	520	827
DR	**Zoom format**	**HIGH**	**1050**	**1669**
DSA	Zoom format	HIGH	1050	1669
PFL	Zoom format	HIGH	1050	1669
DCM	**Zoom format**	**LOW**	**1100**	**1749**
DCM	**Zoom format**	**MID**	**1850**	**2941**
EB	**Zoom format**	**MID**	**2100**	**3339**

Operating mode	I.I. format	Dose rate level	Dose rate at the I.I. input (nGy/s)	Dose rate at the I.I.input * Grid correction factor * Dose measuring chamber correction factor (nGy/s)
DCM	Zoom format	HIGH	3650	5803
EB	Zoom format	HIGH	4200	6678

Table 3

Setting values:
Tolerances during the dose rate setting: $\pm$ 5%.
The positive tolerance range should be utilized preferably for the setting.

1) Note on the FL / Zoom format / Low dose rate level

For setting in this operating mode, the BRIGHTNESS DEVIATION may be greater than ± 3.

Therefore, when measuring the dose rate for FL / Zoom format / Low in normal operation, the dose rate can be a maximum of twice that for FL / Full format / Low.

If the BRIGHTNESS DEVIATION is greater than $\pm$ 3 after the dose rate setting, the position values of the TV iris diaphragm for the FL operating mode and LOW dose rate level in Full format and Zoom format must be read and evaluated.

(Service PC, menu "Adjustments... / Parameters... , Parameter "DOSE ADJ. II. FULL FORMAT / FL LOW - FULL POS" and Parameter "Dose ADJ. II. ZOOM FORMAT / FL LOW ZOOM POS".)

- If, after setting, the error message 6231 is displayed, the parameter "DOSE ADJ. II. FULL FORMAT / FL LOW FULL POS" must be read and the parameter "DOSE ADJ. II. ZOOM FORMAT / FL LOW - ZOOM POS" must be programmed to the read value +1.
  - Permissible parameter values are:
    FL LOW - ZOOM POS > FL LOW FULL POS
    Inadmissible parameter values are:
    FL LOW ZOOM POS <= FL LOW FULL POS.
- If, after setting, the error message 7501 is displayed, the parameter "DOSE ADJ. II. FULL FORMAT / FL LOW - ZOOM POS" must be read and the parameter "DOSE ADJ. ALL MODES / TV-IRIS MAX POS" must be programmed to the read value +1.
  - Permissible parameter values are:
    TV-IRIS MAX POS > FL LOW ZOOM POS
    Inadmissible parameter values are:
    TV-IRIS MAX POS <= FL LOW ZOOM POS

Correction factors:

DALI and NOMEX dose measuring device, large measuring chamber: 1.06
23 cm (9") I.I.: Grid correction factor: 1.5

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Use radiation protection. Wear a lead apron when making the adjustments! Keep the fluoro time as short as possible! Maintain a safe distance!

Measuring setup

- The grid should be attached to the I.I.
- Center the dose measuring chamber on the I.I. input screen and attach it.

NOTE

If a dose measuring device with a solid-state detector is used, take care that the solid-state detector lies outside the dominant of the dose rate control.

The dominant has a diameter of approx. 6 cm in relation to the monitor screen.

The dose measuring chamber correction factor is not to be taken into account in this case. The dose rates then result from: [Dose rate at I.I. input (nGy/s)] * [Grid correction factor].

- Attach 20 mmAL + 1.2 mm (4 x 0.3 mm) CU to the POWERPHOS radiation exit window.

NOTE

If the setting sequence described in Table 3 is followed, it is useful to adjust the prefiltration of these types of operations before setting the dose rate so that a tube current of approximately 0.3 mA to 0.6 mA is displayed on the console:

- **FL, full format, LOW**
- **DR, full format, HIGH**
- **FL, zoom format, LOW**
- **DR, zoom format, HIGH.**

The dose rate values that fall in between can then be set without having to change the prefiltration.

NOTE

If the dose rate value to be set cannot be attained, adjust the prefiltration accordingly.

NOTE

To prevent inaccuracies, the measuring chamber of the dose rate measuring device must be fully irradiated during setting.
For dose rate settings in Zoom format, the X-Iris is opened automatically, so that the entire area of the dose measuring chamber is irradiated.

Setting the dose rate

- "Dose rate adjustment" must be selected.
- "Update Start" must be selected.
- Begin in the FL operating mode with a LOW dose rate level.
- Select fluoroscopy. The LED in the key (1/Fig. 2) lights up.
- Select I.I. full format. The LED in the key (7/Fig. 2) is off.
- Select kV Stop. The LED in the key (8/Fig. 2) lights up.
- With pressing the kV+ or kV- key, 75 kV are displayed.
- Select dose rate level LOW. One LED in the display (15/Fig. 2) lights up.

1. Switch radiation on (fluoroscopy hand switch or fluoroscopy foot switch).
2. Set the dose rate with the kV+ and kV- keys according to the table (coarse adjustment).
3. The value can be adjusted with the mA+ and mA- keys in 1/16 exposure points (fine adjustment).
4. Then set the Brightness Nom - Brightness Act deviation with the camera rotation keys (11/Fig. 2), shown in the display (13/Fig. 2) to 0 ± 3.
5. When the key (12/Fig. 2) is selected (LED in the key lights up), the TV Iris will move more slowly (fine adjustment).
6. Then press the key (14/Fig. 2). The current TV iris diaphragm position will be stored.
7. Switch radiation off.
8. Read and write down the TV-IRIS ACTUAL POSITION, displayed on the service PC.
9. Check the TV iris diaphragm position for plausibility.
   If the setting from low dose rate values to high dose rate values is performed (sequence as per Table 3), ensure that the current TV iris diaphragm value is not higher than or equal to the previously set value.

- Select the MID dose rate level.
- Set the dose rate values for the FL operating mode/ Full format/ Dose rate level MID.
- Set the remaining dose rate values for the corresponding operating modes, I.I. formats and dose rate levels (Step 1. to 9.). Pay attention to the notice about the prefiltration.
- Do not exit the dose rate setting window yet! First perform the TV iris diaphragm adjustment!
  See paragraph below, "Calibrating the TV iris diaphragm for automatic iris diaphragm regulation".

Note on dose rate setting for EB (EB = Single Image mode)

The ROAD key (6/Fig. 2) is programmed to select the EB operating mode during dose rate adjustment. When EB is selected, the LED flashes in the key (3/Fig. 2).

Calibrating the TV iris diaphragm for automatic iris diaphragm regulation (AIR)

NOTE

To calibrate the TV iris diaphragm for AIR, in addition to the dose rate adjustments the dose rate must be measured with the TV iris diaphragm at max. aperture, and the measured dose rate value must be programmed.

Measuring the minimum dose rate with the TV iris diaphragm at max. aperture

- Release the Stop key; the automatic dose rate control is active (8/Fig. 2), the LED in the key is off.
- Zoom off, the LED in the key (7/Fig. 2) is off.
- The last programmed operating mode remains selected.
- Attach approx. 1.8 mm Cu (depending on the GX of the I.I.) to the POWERPHOS radiation exit window.

- Switch fluoroscopy on.
- With radiation on, open the TV iris diaphragm to max. aperture with the right image rotation key (11A/Fig. 2).
- Wait for the generator values to stabilize. The Brightness Act. - Brightness Nom. deviation indicated in the display (13/Fig. 2) must be 0 ± 3. In the event of a larger Brightness Act. - Brightness Nom. deviation, switch fluoroscopy off, change the prefiltration, release fluoroscopy again and wait for the generator values to stabilize.
- Read out the dose rate value on the dose rate measuring device and record it.
- Switch fluoroscopy off.
- Zoom on, the LED in the key (7/Fig. 2) lights up.

- Switch fluoroscopy on.
- With radiation on, open the TV iris diaphragm to max. aperture with the right image rotation key (11A/Fig. 2).
- Wait for the generator values to stabilize. The Brightness Act - Brightness Nom. deviation, shown in the display (13/Fig. 2) must be 0 ± 3.
- Read out the dose rate value on the dose rate measuring device and record it.
- Switch fluoroscopy off.
- Exit dose rate setting (Update Stop)
- Close the monitoring window by selecting Cancel.

Calculating the dose rate values to be programmed

If a dose rate measuring device with measuring chamber is used (PTW DALI / PTW NOMEX)

$$= \frac{\text{measured dose rate}}{\text{grid correction factor} * \text{dose measuring chamber correction factor}}$$

$$= \frac{\text{measured dose rate}}{1.59}$$

If a dose rate measuring device with a solid-state detector is used (e.g. PTW DIADOS):

$$= \frac{\text{measured dose rate}}{\text{grid correction factor}}$$

$$\frac{\text{measured dose rate}}{1.50}$$

Calculate both dose rate values for full and zoom format.

Programming the calculated dose rate values

- Select the "Adjustment…, Parameters…" menu.
- Click on "Get from Unit".
- Select "DOSE ADJ, ALL MODES" in the combo box.
- Select the parameter "MIN DOSERATE NORMAL".
- In the "Actual value" field, enter the previously calculated minimum dose rate for full format (in [nGy/s]).
- Click on "Set Value".
- Select the parameter "MIN DOSERATE ZOOM".
- In the "Actual Value" field, enter the previously calculated minimum dose rate for zoom format (in [nGy/s]).
- Click on "Set Value".
- Click on "Put to unit".
- Exit the window.

Concluding tasks

- Before exiting the service program, save the new parameters to disk (Service PC, Data menu, Backup).
- Switch off the unit and on again, so that the new dose rate settings are accepted.
- Check the set dose or dose rate.

Checking the set dose or dose rate

Measuring setup

- The grid remains on the image intensifier.
- Fasten the dose measuring chamber centrally on the image intensifier input screen.

NOTE

If a dose measuring instrument with solid-state detector is used, take care that the solid-state detector lies outside the dominant of the dose rate control.
The dominant has a diameter of approx. 6 cm in relation to the monitor screen.
The dose measuring chamber correction factor is not to be taken into account in this case. Then calculate the dose rate on the image intensifier input screen from [measured dose rate (nGy/s) / grid correction factor] and compare it with the table.

NOTE

For measurements with zoom format:
Take care that the dose measuring chamber is irradiated over its entire area. Check the centering of the dose measuring chamber with zoom format selected.

Correction factors

Grid correction factor:	1.5
Dose measuring chamber correction factor:	1.06

Prerequisites

System in normal mode - no service functions active.
KV-Stop is not active. The LED of the KV-Stop button is off.

Checking the dose rate values

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Use radiation protection. Wear a lead apron when making the checks! Keep the fluoro time as short as possible! Maintain a safe distance!

NOTE

The ADC control characteristics are calculated for water values. There is a lower scattered radiation proportion if copper is used as prefilter.
The kV/mA transfer values on changing over the operating modes are therefore subjected to larger tolerances.
Thus after changing over the operating modes and releasing radiation, wait until the dose or dose rate value control has stabilized again.
After changing over to the DR mode with programmed K factor of k > 1, release at least 2 exposures before the dose measurement until the dose control is adjusted (= no further change of the kV/mA display values).
After changing over to the EB mode (= DR mode with k=1) release approx. 2 to 5 exposures until the dose control is adjusted (= no further change of the kV/mA display).

- Use Cu as prefilter.
- Choose the prefilter so that 75 kV ± 5 kV are displayed on the control console.
- Check the dose rates or dose for the operating modes, dose rate or dose levels, control characteristics and zoom stages stated in Table 4.
- If necessary, temporarily program the control characteristics stated in Table 4 for the mode to be checked.
- Permissible tolerances of the dose rate or dose: see column Tolerances.

I.I. format	Mode	Dose level	Control charac-teristic	Dose rate at the image intensifier input screen	Dose rate or dose * grid correction factor * dose measuring chamber	Tolerances
Full format	FL	LOW	HC2	110 nGy/s	175 nGy/s (149 nGy/s to 201 nGy/s)	± 15%
		MID		185 nGy/s	295 nGy/s (251 nGy/s to 339 nGy/s)	± 15%
	PFL 12 P/s or 15 P/s	LOW	HC2	110 nGy/s	175 nGy/s (149 nGy/s to 201 nGy/s)	± 15%
		MID		185 nGy/s	295 nGy/s (251 nGy/s to 339 nGy/s)	± 15%
		HIGH		370 nGy/s	588 nGy/s (500 nGy/s to 676 nGy/s)	± 15%
	DCM 12 P/s or 15 P/s *2	LOW	HC2	385 nGy/s	612 nGy/s (490 nGy/s to 734 nGy/s)	± 20%
		MID		650 nGy/s	1030 nGy/s (824 nGy/s to 1236 nGy/s)	± 20%
		HIGH		1295 nGy/s	2059 nGy/s (1441 nGy/s to 2677 nGy/s)	± 30%
	DSA *1	MID	IOD	370 nGy/s	588 nGy/s (500 nGy/s to 676 nGy/s)	± 15%
	DR, Noise Reduction K=16	HIGH	HC2	50 Hz:: ***550 nGy*** 60 Hz:: ***455 nGy***	50 Hz:: ***870 nGy (740 nGy to 1000 nGy)*** 60 Hz:: ***722 nGy (614 nGy to 830 nGy)***	± 15%
	DR, Noise Reduction K=1	MID	HC3	50 Hz:: ***60 nGy*** 60 Hz:: ***50 nGy***	50 Hz:: ***95 nGy (67 nGy to 124 nGy)*** 60 Hz:: ***79 nGy (55 nGy to 103 nGy)***	± 30%
Zoom	FL *3	LOW	HC2	160 nGy/s	247 nGy/s (198 nGy/s to 296 nGy/s)	± 25%
		MID		260 nGy/s	416 nGy/s (333 nGy/s to 499 nGy/s)	± 25%
	PFL 12 P/s or 15 P/s	MID	HC2	260 nGy/s	416 nGy/s (333 nGy/s to 499 nGy/s)	± 25%
	DCM 12 P/s or 15 P/s	MID	HC2	915 nGy/s	1452 nGy/s (1162 nGy/s to 1742 nGy/s)	± 30%
	DR, Noise Reduction K=16	MID	HC2	50 Hz:: ***385 nGy*** 60 Hz:: ***320 nGy***	50 Hz:: ***614 nGy (491 nGy to 737 nGy)*** 60 Hz:: ***510 nGy (408 nGy to 612 nGy)***	± 25%

Tab. 4

*1 Check only if DSA option (subtraction) is present.
*2 Check only if DCM option is present.
*3 See also paragraph "1) Notice on dose rate level FL / Zoom format /Low".

Setting the maximum skin dose rate

NOTE **Setting the maximum skin dose rate is only necessary for countries where DHHS regulations apply.**

Prerequisites

- Program one of the FL curves S2, HC 2, HC 3, IOD or CAR and select it for the adjustment.
- The X-ray tube cover must be fitted.
- Use the measuring chamber of the dose measuring device for dose rate measurement >10 R/min.
- If an area dose product measuring device (DIAMENTOR) is present, it must be installed above the radiation exit window of the POWERPHOS.

Preparations

- Attach the dose measuring chamber at a distance of 30 cm (Fig. 3) from the I.I. housing.
- Select one of the FL curves S 2, HC 2, HC 3, IOD or CAR (according to which is programmed).
- Briefly release fluoro.
- Select kV Stop mode and enter 125 kV. The maximum tube current is obtained automatically.

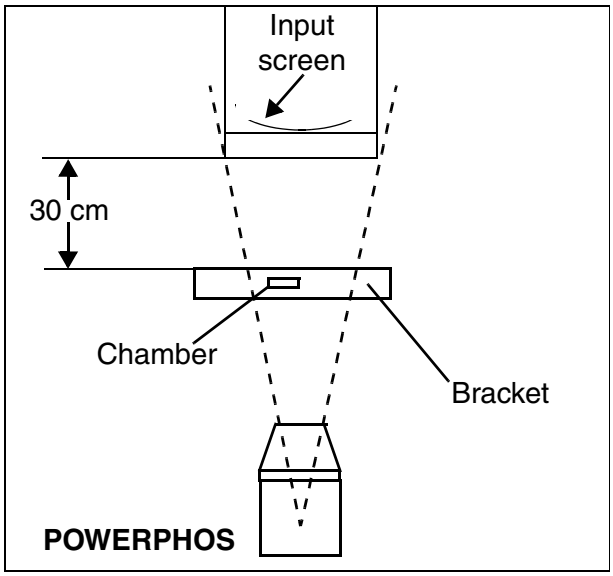


Fig. 3

NOTE **If the maximum tube current was already reduced, the mA value displayed at 125kV should be recorded and used for the calculation. The maximum skin dose rate should be set to 9R/min.**

Measurement

- Switch fluoroscopy on.
- Read and record the dose rate value displayed on the dose rate measuring device.
- If the measured value exceeds 9R/min, the maximum tube current must be reduced. If the measured value is less than 9R/min, the tube current does not need to be reduced.
- Switch fluoroscopy off.

- Calculate the maximum tube current

$$\frac{\text{Tube current displayed in mA at 125 kV} * 9\ (\text{R/min})}{\text{Dose rate value, measured in R/min}} = \text{tube current to be programmed in mA}$$

- Multiply the tube current to be programmed by 10, since this must be entered to the service PC in 1/10 mA steps. Round off the value to the nearest whole number.

Example:	Tube current displayed at 125kV:	4.4 mA
	Maximum skin dose rate:	9R/min
	Measured dose rate value:	11.2 R/min

$$\frac{4.4\ (\text{mA}) * 9\ (\text{R/min})}{11.2\ (\text{R/min})} = 3.53\ (\text{mA})$$

In 1/10 mA: 35.3, rounded off to the nearest whole number: 35

The value to be programmed is 35

Programming

- Connect the service PC to the serial interface of the POWERMOBIL.
- Select the "Adjustment, Parameters..." menu.
- Select "Limitation of skin dose rate (FL)" in the "Parameter Groups" combo box.
- Click on "Get from unit".
- Enter the value to be programmed in "Value".
- Click on "Set Value".
- Select "Put to unit". Follow the menu guidance on the service PC.
- Select "Save to file".
- The value to be programmed has been transferred to the POWERMOBIL and temporarily saved to disk.

NOTE

You must exit the service program with "Logoff" and "Quit". Only then will the modified parameters be stored on the disk as a new file!

Checking

- After programming, check the maximum skin dose rate again.

Collimator, X-Iris

NOTE	**The positions of the semitransparent slot diaphragms are dependent on the mechanics. Open the slot diaphragms to maximum aperture before adjusting the X-Iris.**

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Use radiation protection! Wear a lead apron!**

- Attach the centering cross to the center of the image intensifier input screen.
- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program.
- Select the "Adjustment, Calibrations.." menu.
- Answer the query with "yes".

Start adjustment

- Select "X-Iris" in the "Function Groups" combo box.
- In the "Available Functions:" window select "Init (Limits Off / Autosearch)" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "No".
- The X-Iris can now be completely opened and closed with the X-Iris keys.

Full format, X-Iris open

- Select I.I. full format.

- During fluoroscopy, adjust the X-Iris by opening and closing it with the X-Iris keys, so that the blades are still visible along the edge of the I.I. screen.
- Select " II. - Full Format Position" on the service PC and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "No".

Zoom format, X-Iris open

- Switch to zoom format.

- During fluoroscopy, adjust the X-Iris by opening and closing it with the X-Iris keys, so that the blades are still visible along the edge of the I.I. screen.
- Select " II. - Zoom Format Position" on the service PC and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "No".

X-Iris minimum aperture

- Close the X-Iris completely.
- During fluoroscopy, adjust the X-Iris by opening and closing it with the X-Iris keys to a diameter of < 4.5 cm; > 4 cm.
- Select "CLOSED POSITION" on the service PC and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "No".

Save values and end adjustment

- Select "Init Off & Store Positions" on the service PC and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "Yes".
- Switch the POWERMOBIL off and then on again.

Concluding tasks

- Check the X-Iris again in full format and zoom format. The blades must still be visible on the edge of the image. If necessary, repeat the adjustment.
- Return to the main menu on the service PC with the ESC key.
- Before exiting the service program, save the new parameter values to disk (Service PC, menu "Data Backup").

Collimator, slot diaphragm

NOTE	**With existing CARD collimator, the two blades of the slot diaphragm are shown on the monitor off-center.**

Prerequisites

- Camera rotation must be correctly adjusted.
- The image reversal functions must be disabled.
- Connect the service PC to the serial service interface.
- Start the service program.
- Select the "Adjustment, Calibrations..." menu.
- Respond to the query with "Yes".
- Mark the circle mask diameter in the upper left corner and lower right corner on the screen of monitor A.

Disable circle mask

- Select "Slot Diaphragm" in the "Function Groups:" combo box.
- In the "Available Functions:" window, select "Disable circle mask" and click on "Execute". The circle mask in memory is switched off.
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".

Start adjustment

- Select "INIT (LIMITS OFF/ AUTOSEARCH)" in the "Available Functions:" window and then click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".
- The mechanical limits are checked and the position values are stored automatically.
- The camera rotation is automatically moved to the 0° position.
- The X-Iris is opened to max. aperture.

Slot diaphragm, 0° position

- Switch off zoom.
- Attach a centering cross or similar object to the I.I. in order to evaluate the position of the fluoro image.

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Use radiation protection! Wear a lead apron!

- Switch on fluoro and move the slot diaphragm to the 0° position using the slot diaphragm rotation keys. The blades should be vertically positioned on the monitor screen.
- Switch off fluoro.
- In the "Available Functions:" window select "0 DEGREE POSITION" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".

Full format, slot diaphragm open

- The blades are automatically moved into the setting position (rotated approx. 45°).

- Switch on fluoro.
- Open the slot diaphragm until the two blades are located outside the marking of the circle mask.
- Switch off fluoro.
- In the "Available Functions:" window select "II.-FULL FORMAT POSITION" and click on "Execute".

- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".

Zoom format, slot diaphragm open

- The blades are automatically moved into the setting position (rotated approx. 45°).
- Select zoom format.

- Switch on fluoro.
- Open the slot diaphragm until the two blades are located outside the marking of the circle mask.
- Switch off fluoro.
- In the "Available Functions:" window select "II.-ZOOM FORMAT POSITION" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".

Slot diaphragm closed

NOTE	**During initialization (see paragraph Start adjustment), this value is already learned and stored. Setting can therefore be skipped. Exception: On customer request the minimum spacing between the blades can be increased according the following description.**

Prerequisite:

- Perform the setting of the slot diaphragm as described above, including "Zoom format, slot diaphragm open".
- Select zoom format.
- Switch on fluoro.
- Open slot diaphragm to customer's request.
- Switch off fluoro.

NOTE	**The spacing between the blades must be smaller than for the setting "Zoom format, slot diaphragm open".**

- Select "CLOSE POSITION" on the service PC.
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit" click on "No".

Enable circle mask

- In the "Available Functions:" window select "Enable circle mask" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit" click on "No".

Save values and end adjustment

- In the "Available Functions:" window select "INIT OFF & STORE POSITION" and click on "Execute".
- For the query "Do you want to reset the unit", click on "Yes". The adjustment values are stored.

Concluding tasks

- Switch the system off and then on again.
- Return to the main menu by pressing ESC on the service PC.
- Before exiting the service program, save the new parameter values to disk (Service PC, Data menu, Backup).

Collimator display on the monitor

Prerequisites

- Camera rotation, collimators for X-Iris and slot diaphragm must be set correctly.

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Use radiation protection! Wear a lead apron!**

Collimator display, X-Iris

- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program.
- Select the "Adjustment, Calibrations..." menu.
- Respond to the query with "Yes".
- Select "Screen Display XIRIS" in the "Function Groups:" combo box.

Start adjustment

- In the "Available Functions:" window select "Init" and click on "Execute". The X-Iris is automatically opened to full format and the slot diaphragm is opened to maximum aperture.

Full format, X-Iris open

- Zoom must be disabled.

- Release fluoro and wait until generator has performed automatic adjustment.
- Switch fluoro off. The X-Iris is displayed on the monitor.
- Use the keys for opening and closing the X-Iris to set the diameter of the superimposed circle to the size of the X-iris.
- In the "Available Functions:" window select "Open Pos - II. Full Format" and click on "Execute".

- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No". The X-Iris is automatically closed to the smallest format.

Full format, X-Iris closed

- Briefly release fluoro. The X-Iris is displayed on the monitor.
- Use the keys for opening and closing the X-Iris to set the diameter of the superimposed circle to the size of the X-Iris.
- In the "Available Functions:" window select "Close Pos - II. Full Format" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".
- The X-Iris remains in the minimum position.
- Zoom format is automatically selected.

Zoom format, X-Iris closed

- Briefly release fluoro. The X-Iris is displayed on the monitor.
- Use the keys for opening and closing the X-Iris to set the diameter of the superimposed circle to the size of the X-Iris.
- In the "Available Functions:" window select "Close Pos - II. Zoom Format" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit" click on "No".
- The X-Iris is opened automatically.
- Zoom format remains selected.

Zoom format, X-Iris open

- Briefly release fluoro. The X-Iris is displayed on the monitor.
- Use the keys for opening and closing the X-Iris to set the diameter of the superimposed circle to the size of the X-Iris.
- In the "Available Functions:" window select "Open Pos - II. Zoom Format and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "No".

Save values and end adjustment

- In the "Available Functions:" window select "INIT OFF & STORE VALUES" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the unit", click on "Yes".

Concluding tasks

Before ending the service program, save the new parameter values to disk (Service PC, Data menu, Backup).

Collimator display, slot diaphragm

NOTE	**With an existing CARD collimator, the two blades of the slot diaphragm are shown on the monitor off-center.**

NOTE	**Setting the slot diaphragm display is performed with respect to the visible front edge of the semitransparent slot diaphragm blades. With an existing CARD collimator, the slot diaphragm blades are displayed approx. 25 mm further to the outside after the setting procedure. This ensures that, in the middle kV range, the displayed slot diaphragm blades mark the limit of the visible shadowing in the fluoroscopic image more or less.**

Prerequisites

- The setting of the camera rotation is correctly adjusted and is in the 0° position.
- With existing CARD collimator, the parameter "OFFSET" (see "Adjustments..., Parameters..., SLOT DIAPHRAGM SCREEN DISPLAY") must be set to the value 50. With existing standard collimator, the parameter "OFFSET" must be set to the value 0.
- Mark the circle mask diameter in the upper left corner and lower right corner on the screen of monitor A.
- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program.
- Select the "Adjustments, Calibrations..." menu. Answer the query with "Yes".
- Select "SCREEN DISPLAY SLOT DIAPHRAGM" in the "Function Groups:" combo box.

Disable circle mask

- Switch off zoom.
- In the "Available Functions:" window, select "DISABLE CIRCLE MASK" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

Start adjustment

- In the "Available Functions:" window select "INIT" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

Full format, slot diaphragm open

- Move the camera to the 0° position.

  ➪ The X-Iris opens automatically and can be opened further with the keys for opening the X-Iris.

  ➪ The slot diaphragm moves automatically to the default position for full format (rotated approx. 45°).

- Release fluoro briefly.
- Open and close the slot diaphragm display using the control keys.
- Set the line shown on the monitor so that it coincides with the front edge of the lower right blade.
- In the "Available Functions:" window select "OPEN POS - II. FULL FORMAT" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

Full format, right slot diaphragm closed

- The slot diaphragm closes automatically.

- Release fluoro briefly.
- Open and close the slot diaphragm display using the control keys.
- Set the line shown on the monitor so that it coincides with the front edge of the lower right blade.
- In the "Available Functions:" window select "RIGHT POS. II. - FULL FORMAT" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

Full format, left slot diaphragm closed

- The slot diaphragm remains closed.

- Release fluoro briefly.
- Open and close the slot diaphragm display using the control keys.
- Set the line shown on the monitor so that it coincides with the front edge of the upper left blade.
- In the "Available Functions:" window select "LEFT POS. II - FULL FORMAT" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

Zoom format, slot diaphragm closed

- Release fluoro briefly.
- Open and close the slot diaphragm display with the control keys.
- Set the line shown on the monitor so that it coincides with the front edge of the lower right blade.
- In the "Available Functions:" window select "CLOSE POS - II. ZOOM FORMAT" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

  ➪ The slot diaphragm opens automatically and should still be visible in the corners of the image.

Zoom format, slot diaphragm open

- Release fluoro briefly.
- Open and close the slot diaphragm display with the control keys.
- Set the line shown on the monitor so that it coincides with the front edge of the lower right blade.
- In the "Available Functions:" window select "OPEN POS - II. ZOOM FORMAT" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the Unit", click on "No".

Enable circle mask

- In the "Available Functions:" window select "Enable Circle Mask" and click on "Execute". Close the status window by clicking on the OK button.
  For the query "Do you want to reset the unit", click on "No".

Save values and end adjustment

- In the "Available Functions:" window select "INIT OFF & STORE VALUES" and click on "Execute". Close the status window by clicking on the "OK" button.
  For the query "Do you want to reset the Unit", click on "Yes".

Concluding tasks

- Before exiting the service program, save the new parameter values to disk (Service PC, Data menu, Backup).
- Remove the markings of the circle mask diameter again.

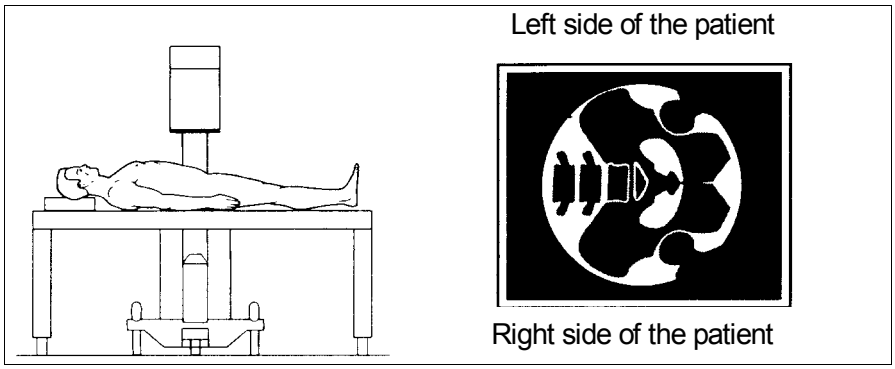


Fig. 4

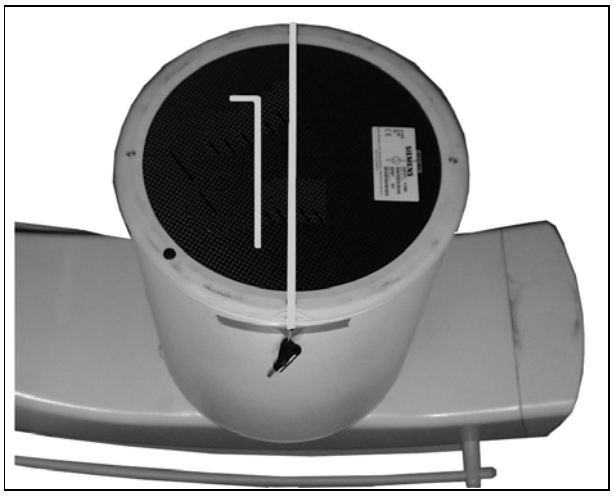


Fig. 5

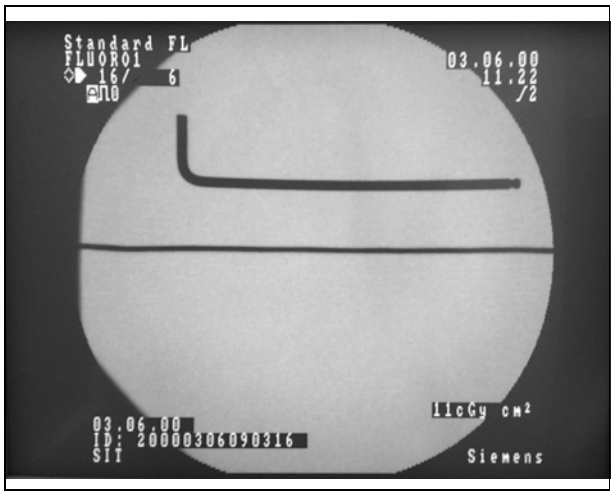


Fig. 6

Camera rotation

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Use radiation protection! Wear a lead apron!**
NOTE	**The position of the VIDEOMED DC to the camera rotation mechanism must be set correct.** **See Chapter 6 "Replacing the VIDEOMED DC, Camera rotation 0° position".**
NOTE	**Before adjusting the camera rotation, the keys for horizontal and vertical image reversal must be off. Camera rotation should be set to the 0° position. Fig. 4, Fig. 5 and Fig. 6 show the 0° position.**

NOTE

With the right camera rotation key (arrow on key pointing clockwise) the marker superimposed on the monitor will rotate clockwise, but the image contents will rotate counterclockwise.

With the left camera rotation key (arrow on key pointing counterclockwise) the marker superimposed on the monitor will rotate counterclockwise, but the image contents will rotate clockwise.

- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program.
- Select the "Adjustment, Calibrations..." menu.
- Answer the query with "Yes".

Start adjustment

- Select "Camera Rotation" in the "Function Groups:" combo box.
- In the "Available Functions:" window select "Init (Disable Limits)" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "No".
- As shown in Fig. 5, mount a piece of wire and an Allen key to the I.I. input screen. Fig. 6 shows the corresponding fluoro image at 0 degree camera rotation position.

Camera rotation +180° position

- Switch on fluoro and rotate the camera to the + 180° position with the clockwise camera rotation key. The image contents will rotate counterclockwise.
- Switch off fluoro. In the "Available Functions:" window select "+180 Degree Position" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit" click on "No".

Camera rotation 0° position

- Switch on fluoro and rotate the camera to the 0° position. The image (left/right / up/down) will correspond to Fig. 6.
- Switch off fluoro. In the "Available Functions:" window select "0 Degree Position" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit" click on "No".

Camera rotation -180° position

- Switch on fluoro and rotate the camera to the -180° position (with the counterclockwise camera rotation key). The image contents will rotate clockwise.
- Switch off fluoro. In the "Available Functions:" window select "-180 Degree Position" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit", click on "No".

Save values and end adjustment

- In the "Available Functions:" window select "Init Off & Store Positions" and click on "Execute".
- Close the status window by clicking on the OK button.
- For the query "Do you want to reset the Unit" click on "Yes".
- Return to the service program main menu using the ESC key.

Concluding tasks

- Before exiting the service program, save the new parameter values to disk (Service PC, Data menu, Backup).

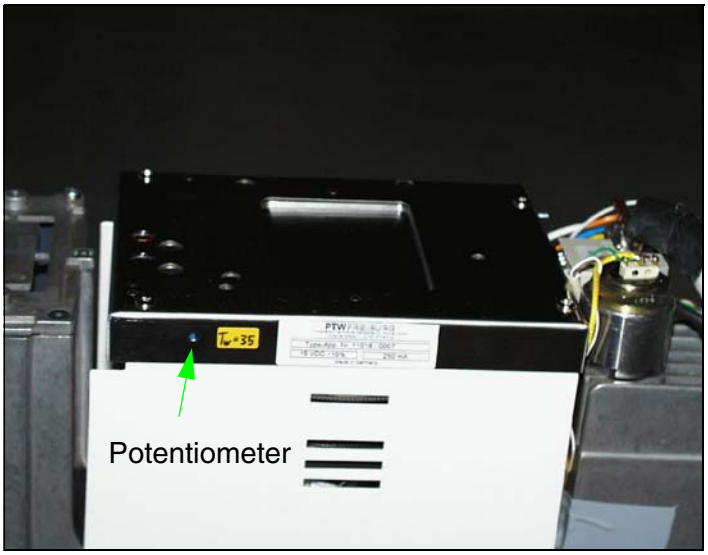


Fig. 7

Calibrating the area dose product measuring device

NOTE	**This adjustment is used to calibrate the area dose product measuring device to the POWERMOBIL display.**

CONSTANT parameters = T_W

- Read and record the T_W value shown on the electronics unit of the area dose product measuring device (see Fig. 7).

Programming

- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program.
- Select the "Adjustment, Parameter..." menu.
- Select "Diamentor" in the "Parameter Groups" combo box.
- Click on "Get from Unit".
- The parameter "1. Diamentor Existing" must be on YES.
- Select parameter "2. Constant T_W.
- Enter the parameter T_W in the "Value Actual:" field.
- Click on "Set Value".
- Click on "Put to Unit".
- Click on "Save to File".

NOTE	**You must exit the service program with "Logoff" and "Quit" in order to save the modified parameters to disk as a new file.**

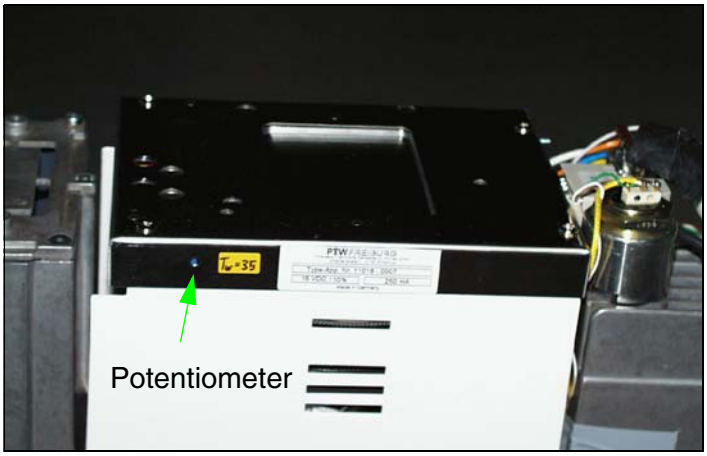


Fig. 8

Checking the programmed value

NOTE	**Checking the programmed values will activate the self-test in the electronics unit of the area dose product measuring device. This serves to recalibrate the electronics unit.**

Prerequisites

- The T_W value is already programmed (see Programming).
- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the service program.
- Select the "Adjustment, Calibrations..." menu.
- Answer the query with "Yes".
- Select "Diamentor" in the "Function Group:" combo box.
- In the "Available Functions" window select the line "Start Diamentor Test" and click on "Execute".
- Close the status window by clicking on the Ok button.
- Respond to the query "Do you want to reset the unit" by clicking "No".
- Press the >0< key (reset key for fluoroscopy time). The current value is displayed on the monitor.
- The tested T_W value is displayed on the monitor of the POWERMOBIL.
- This value must match the programmed CONSTANT parameter T_W . Tolerance: ± 5 %.
- If the ->0<- key is pressed (reset key for fluoroscopic time) the test is repeated and is displayed again on the monitor.
- The potentiometer (Fig. 8) of the area dose product measuring device can be used to adjust the test value T_W to the programmed value T_W .
- After the adjustment, select "Stop Diamentor Test" on the service PC and click on "Execute".
- Close the status window by clicking on the Ok button.

- Respond to the query "Do you want to reset the unit" by clicking "No".
- The test is concluded. Check the accuracy of the area dose product measuring device (see next page).

Checking the accuracy of the area dose product measuring device

Prerequisites

The calibration of the measuring device must already have been performed.
The X-Iris is correctly set; the blades are still just visible on the monitor screen.

Preparations.

- Attach the centering cross in the center of the I.I. (Fig. 9).
- Select I.I. zoom format.
- Select kV-mA-curve plateau IOD.
- Attach the small (1 cm^3) dose measuring chamber in the center of the I.I. (Fig. 10.

NOTE **The radiation field must cover the entire area of the dose measuring chamber. If necessary, center the dose measuring chamber on the I.I. again.**

- Release fluoroscopy briefly, adjusting the X-Iris on the radiation field of approx. 8 cm.
- Do not make any further adjustments to the X-Iris.
- Record the inner diameter (key width, Fig. 11) of the octagonal area of the radiation field.
- Remove the centering cross.
- The measuring chamber is still in the center of the I.I. .

Dose measurement

- Press the "Next Pat" key to reset the area dose product display on the POWERMOBIL monitor to 0.
- Select kV STOP and set manual to 70 kV.
- Reset the dose measuring device (Dali, Nomex ...) to 0.

- Release fluoroscopy for approx. 20 seconds (~ 3mGy). The measured dose K_E should be high enough that the selected measurement range of the dose measuring device (Dali, Nomex...) is fully utilized; if necessary, reset the area dose product display on the POWERMOBIL and the dose measuring device and repeat the measurement with a different fluoroscopic time (Check these selections again: I.I. zoom format, kV-Stop, 70 kV).
- Record the measured dose K_E.
- Record the area dose product FDPa, displayed on the POWERMOBIL.

Calculating the area dose product

- To calculate the measured area dose product: (measured area dose product FDPg) = (measured dose K_E) * (inner diameter d)^2 * 0.829.

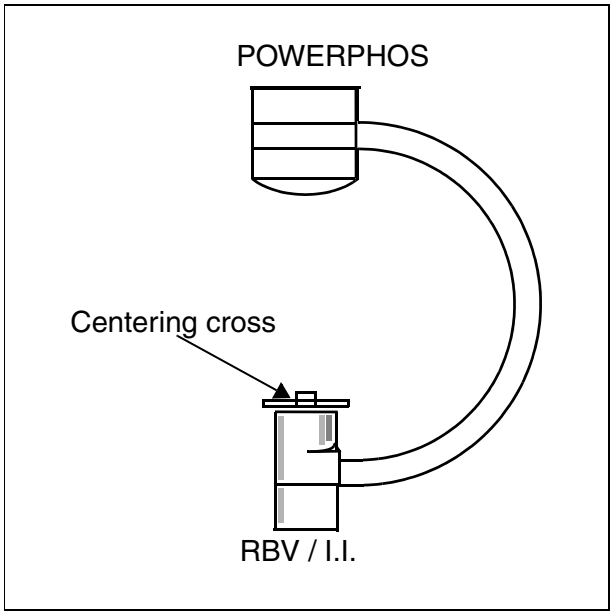


Fig. 9

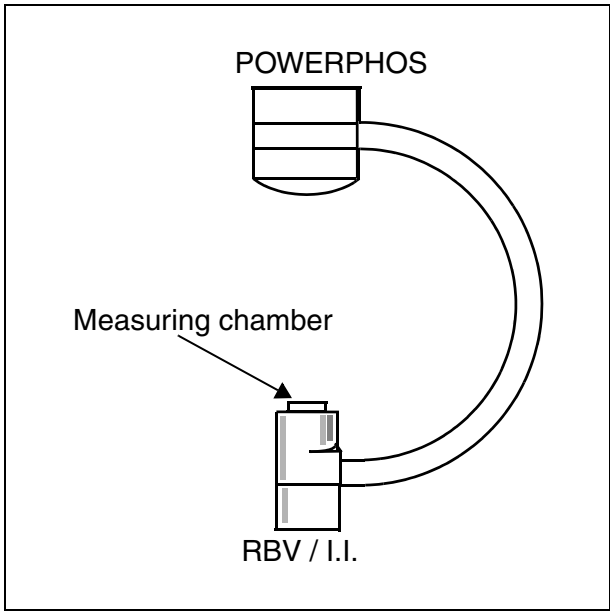


Fig. 10

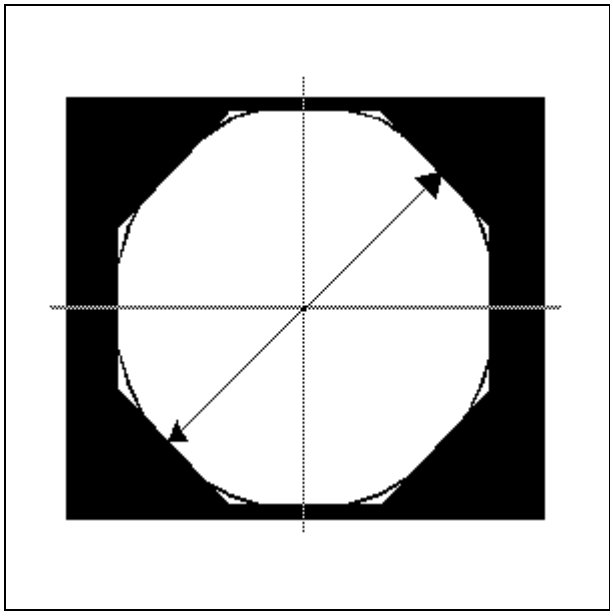


Fig. 11

Evaluation

Calculate the deviation between the measured area dose product FDPg and the displayed area dose product FDPa:
The deviation must be < 0.3.

Deviation = [(displayed area dose product FDPa) - (measured area dose product FDPg)] / (measured area dose product FDPg).

For deviations > 0.3, the area dose product measuring device must be replaced.

Overview of POWERMOBIL parameters

Call up the "Moreinfo.hlp" help file on the service PC for a short description of the parameters available on the POWERMOBIL..

NOTE	**If parameters have been changed and saved in the "Adjustments, Parameter" menu with Save to file, you must exit the service program with "Logoff" and "Quit" in order to save the modified parameters to disk.**

Overview of MEMOSKOP Fast parameters

The "CDATA.HLP" help file contains a short description of the respective parameters. The Operating Instructions describe the parameters that can be accessed by the customer.

Cable module

- Check the auxiliary voltages at test points TP1= +15 V, TP2= 0V GND, TP3= -15 V, LED D4 lights up. 24 V at plug ST1.1= +24 V and ST1.2= 0V. (Tolerance: 22.8 V to 29.5 V).

Holding force after orbital movement of C-arm

- Voltage at TP6 approx. 9 - 13 V. Adjustable with potentiometer P1.

Sensor

- Move C-arm to horizontal position, with control unit on top.
- Switch off orbital brake.
- Move C-arm approx. 10 cm in clockwise direction.
- LED D3 lights up at half intensity, at TP4 1 V ± 0.1 V. Adjustable by loosening and rotating the sensor. Following adjustment tighten down lock nut again.

LED D6 motor fault

- If LED D6 lights up, the motor is then not enabled.
  Possible causes: Short circuit or break in sensor, logic control defective.

Control board D1

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Observe the safety instructions!**

NOTE	**If possible, read out the load counter values and store them on disk. In the case of a tube replacement, return the current load counter data as well as the load counter data stored on failure of the board D1 along with the defective POWERPHOS.**

Replacement and additional work

- Withdraw the slide-in module with D1 and D30 in working position (see Chapter 1, "Service position of the board slide-in module").
- Loosen all plug connections to board D1.

NOTE	**The board D1 is delivered as spare part with the basic configuration stored in the GAL J32. If J32 is not replaced by the module on the defective board, the possibly enabled options of the system are no longer available!** **Remove the IC with the designation J32 from the old board D1 and plug it on the new board D1 in the base J32.**

- Replace the board D1. Pay attention to the insulating disks.
- Plug back all connection cables. Pay attention to correct location of the shields and ground wires.
- Plug in or switch the jumpers and switches according to the wiring diagram. Specially check the jumpers X95, X96, and X99.
- Disable the FIFO at the service PC, serial port (COM1 or COM2).
- Perform the download of the control board D1.
- After download wait around 1 min. and wait for booting.

NOTE	**After the change of the board D1, the heat values, stored in the NVRAM will not be initialized. Therefore the temperatur indicator lights up and the KV/mA displays are flashing.** **The heat unit counter is decreasing the values automatically during a view minutes and the unit is ready for the necessary adjustments.** **For decreasing the waiting time, the heat counter may be reset and the unit is then immediately ready for use.**

Reset the heat values after change of the board D1

- Select the menu "Adjustments...".
- Select the sub menu "Calibrations..."
- Answer the query with "yes".

- Select "Reset Tube values" in the "Function Groups:" combo box.
- Select "Heat Value" and click on the "OK" button.
- Answer the query "Do you want to reset the Unit?" with "Yes".
- After the restart, the unit is ready for use.

Transfer of the parameters

- Transfer the parameters of the system to the board D1.
  Select "DATA" menu, "RESTORE" parameter and click Restore.
- Check the dose rate and if necessary adjust it.
- Check the function of the camera rotation, adjust if necessary.
- Check the function of the collimator, adjust if necessary.
- Check the function of the collimator displays on the monitor and adjust if necessary.
- Check the function of the area dose product measuring device (if present).
- Check the FL / PFL / DCM / DR functions.

Interface board D30

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off before replacing the board.

- Replace the interface board D30.
- Check the +27 V /+24 V /+24 V voltages, adjust if necessary (see Chapter 3 of these instructions "Checking the operating voltages"). Check the radiation release / format switch-over / vertical column travel / brake functions.

Generator, D21 including MCB2

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off before replacing the board.

- Loosen all plug and screw connections to the D21.
- Mount the fan.
- Replace the D21. Pay attention to the insulating disks.
- Make plug and screw connections. Pay attention to the correct location and contact of the shields and ground wires.
- Perform generator download. After the download, switch the system off and on again.
- Perform generator learning and mAs adjustment.
- Perform the IQ quick test.

Power supply unit D20

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off.

Wait until the LED's V147 and LED F3-F8 have gone out.
To ensure safety, after discharge of the Elko batteries the voltage can be checked at test points U_{z-} and U_{z+} .
The voltage must be < 20 V.

- Measure the ZW voltage. The voltage must be $\leq$ 20 V.
- Loosen all plug and screw connections which go to the outside from the generator unit, the boards D20, D21 and D115, also the 3 internally located connectors on the bottom of D20.
- Unscrew the lateral plastic covers.
- Remove the 4 fastening screws on the back of the unit.
- Push the unit out to the side and place it on a suitable base.
  Pay attention to the cables and ribbon cables, otherwise risk of damage.
- Remove the coil connections X10 and X11 on D20.
- The front aluminum plate has 9 fastening screws with contact washers, in each case 3 above and 3 on the sides. Loosen only the lower screws located on the sides. Unscrew the upper 7 screws.
- Hinge up the front aluminum plate and loosen the internal plug connections.
- Remove the board D20 including cooling plate.
- Install the new board D20 including cooling plate.
- Assembly and installation of the unit is performed in the reverse order.
- Tighten the cable connections X7 to X11 with a torque of 4.8 Nm.
- Perform visual inspection. Pay attention to correct location and contact of the shields and ground wires. Especially the plug connection X5 and X6 on D115.
- Perform generator learning.
- Check FL / PFL / DCM / DR functions.

Starting unit D115

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off.

Wait until the LED's V147 and LED F3-F8 have gone out.
To ensure safety, after discharge of the Elko batteries the voltage can be checked at test points U_{z-} and U_{z+} .
The voltage must be < 20 V.

- Measure the ZW voltage. The voltage must be $\leq$ 20 V.

- Loosen all plug and screw connections which go to the outside from the generator unit, the boards D20, D21 and D115, also the 3 internally located connectors on the bottom of the D20.
- Unscrew the lateral plastic covers.
- Remove the 4 fastening screws on the back of the unit.
- Push the unit out to the side and place it on a suitable base.
  Pay attention to the cables and ribbon cables, otherwise risk of damage.
- The front aluminum plate has 9 fastening screws with contact washers, in each case 3 above and 3 on the sides. Loosen only the lower screws located on the sides. Unscrew the upper 7 screws.
- Hinge up the front aluminum plate and loosen the internal plug connections.
- Remove the board D115.
- Apply heat conduction paste under the power module.
- Install the new board D115.
- Assembly and installation of the unit in the reverse order.
- Perform visual inspection. Pay attention to correct location and contact of the shields and ground wires. Especially the plug connection X5 and X6 on D115.
- Check the FL / PFL / DCM / DR functions.

Generator Elko buffer modules

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off.

Wait until the LED's V147 and LED F3-F8 have gone out.
To ensure safety, after discharge of the Elko batteries the voltage can be checked at test points U_{Z-} and U_{Z+} .
The voltage must be < 20 V.

- Measure the ZW voltage. The voltage must be $\leq$ 20 V.
- Loosen all plug and screw connections which go to the outside from the generator unit, the boards D20, D21 and D115, also the 3 internally located connectors on the bottom of the D20.
- Unscrew the lateral plastic covers.
- Remove the 4 fastening screws on the back of the unit.
- Push the unit out to the side and place it on a suitable base.
  Pay attention to the cables and ribbon cables, otherwise risk of damage.
- Replace the defective Elko buffer module.
- Install the generator unit in the reverse order.
- Check the FL / PFL / DCM / DR functions.

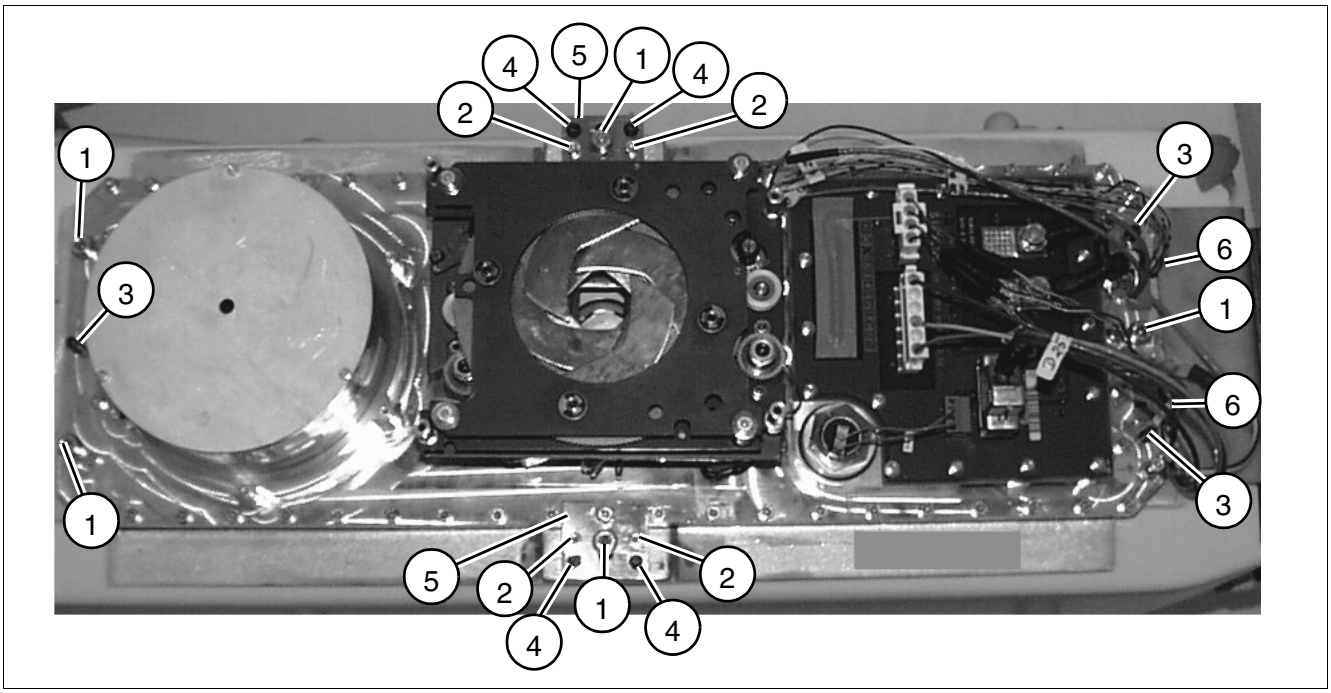


Fig. 1

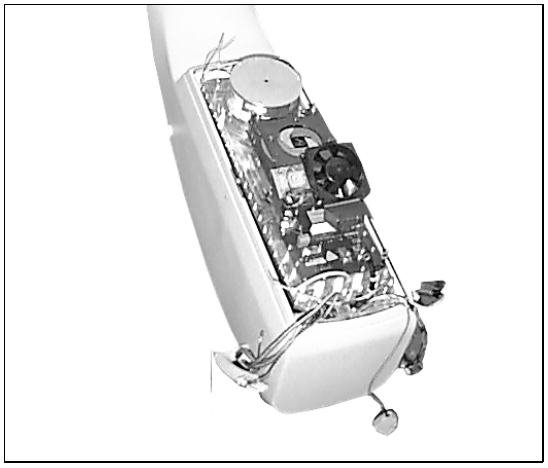


Fig. 2

POWERPHOS

⚠WARNING

Risk of injuries on mechanical parts!
If not observed, slight to medium injuries, especially to the hands, can occur.

Observe the notes concerning the C-arm carbon fiber structure.

Removing the POWERPHOS

- Remove the single-tank cover.
- Before the replacement note the height of all nutating screws (3 and 4/Fig. 1).
- If present, remove the dose measuring chamber.

- Remove the insulating plate of the measuring chamber.

- Remove the collimator.
- Remove the bracket with fan.
- Loosen the fastening screws (1/Fig. 1) of the POWERPHOS.
- To remove the two front cable clips (6/Fig. 1), the front spacing screws can be turned to maximum distance between single-tank holder and C-arm.
- Loosen all plug and screw connections of the cable connections.
- Remove and set down the POWERPHOS.
  - Cable ties of minimum strength type 30 x 6 mm (Fig. 2) can be used for this.
  - Guide cable ties through the front and the two rear holes of the fastening screw.
- Remove the spacer (5/Fig. 1) and attach it to the new POWERPHOS.
- Unscrew the nutating screws (3/Fig. 1) and screw them into the new POWERPHOS.

Installing the POWERPHOS

⚠CAUTION

Risk of injury!
Noncompliance can lead to light to medium injury caused by crushing of the fingers.
Be very careful when inserting the POWERPHOS in the C-arm.

NOTE

The cables must not be crushed!

- **On the basic unit pull out the connector D21.X3 from board D21.**

With an ohmmeter measure from all leads of the connector X3 (cable side) to protective ground wire.
There must be no connection to the protective ground wire!

- Bring the new POWERPHOS into the C-arm. Pay attention to cables and your fingers.
- Attach the collimator.
- If present, attach the dose measuring chamber.
- Install the bracket with fan.
- Connect all cables and plugs and fit the cable clips.

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Observe radiation protection! Wear a lead apron!

- Tighten the cable connections X7 and X9 with a torque of 4.8 Nm.
- Pay attention to perfect cable running of all cables and clamping the shields.
- Set the nutating screws (3 and 4/Fig. 1) to the distances noted at the start.
- Screw in the fastening screws (1/Fig. 1), but do not tighten them but leave a few millimeters distance to the housing.
- Switch on the POWERMOBIL.

- Check the function of the two fans.
  - The visible fan must turn.
  - The fan installed in the C-arm must run audibly. The visible fan can be stopped mechanically for a short time for this.
- Unscrew the nutating screws (4/Fig. 1) a little, so that the POWERPHOS can be centered with the nutating screws (3/Fig. 1).
- Perform generator learning and mAs adjustment.

- Fluoroscopy on.
  Set the collimator opening on the monitor so that all sides are still just visible.
- Fluoroscopy off.
- Determine the direction in which the POWERPHOS must be aligned.
  No image reversal: The collimator sides appear on the monitor above- left side, below- right side, on the left- front side, on the right- rear side.
- By setting the nutating screws (3/Fig. 1) on the POWERPHOS, adjust the collimator centrally on the monitor.
- After each adjustment release fluoro briefly to display the change on the monitor (LIH).
- Set the nutating screws (4/Fig. 1) on the C-arm.
- After the collimator has been centered, tighten the fastening screws uniformly. Take care that the radiation field does not migrate again.
- Switch on fluoroscopy briefly and check the collimator position.
- The blades of the X-Iris must be visible on all sides of the monitor image in fluoroscopy in the full format and zoom format at maximum opening.
- Check and if necessary adjust the X-Iris and slot diaphragm positions (in the full format and zoom format).
- Check the function of the area dose product measuring device (if present).
- For countries in the area of validity of the DHHS regulations, check and if necessary adjust the maximum skin dose.
- A 2nd set of identification labels of the POWERPHOS is glued onto the basic unit. Remove the old identification labels of the collimator and glue the supplied labels at the same place.
  The original labels of the POWERPHOS must agree with the glued on labels.
- If the "MODULARIS" system is present, check the isocenter.

Fans

Visible fan:

- Remove single-tank cover.
- Replace the visible fan.
  - Pay attention to the direction of rotation - airflow in the direction of the single-tank.

Fan installed in the C-arm:

- Removing the POWERPHOS:
  Proceed analogously to Chapter 6 "POWERPHOS, Removing the POWERPHOS".
- Replace the fan installed in the C-arm. Pay attention to direction of rotation.

- Airflow in direction of POWERPHOS.
- Installing the POWERPHOS and checking the fans:
  Proceed analogously to Chapter 6 "POWERPHOS, Installing the POWERPHOS".

Collimator

- Replace the collimator.
- Check the function and setting of the collimator, readjust if necessary,
  (see Chapter 5 "X-Iris collimator and slot diaphragm").

- The blades of the X-Iris must be visible on all side of the monitor image in fluoroscopy in the full format and zoom format.
- Check the collimator displays on the monitor and readjust if necessary
  (see Chapter 5 "Collimator display on the monitor").
- A 2nd set of identification labels of the collimator is glued onto the basic unit. Remove the old labels of the collimator and glue the supplied labels at the same place.
  The original labels of the collimator must agree with the glued on labels.
- If the "MODULARIS" system is present, check the isocenter.

Diamentor

- Remove the single-tank cover.
- Replace the Diamentor.
- Check the function of the Diamentor.
- Perform adjustment of the area dose product measuring device (see under Chapter 5).
- Check the accuracy of the area dose product measuring device (see under Chapter 5).

Replacement of the I.I.

⚠WARNING

Risk of injuries on mechanical parts!
If not observed, slight to medium injuries, especially to the hands, can occur.

Observe the notes concerning the C-arm carbon fiber structure.

2 persons are required for this.

Checking the temperature indicator

- Before attaching the I.I. check the temperature indicators of the I.I.:
- If the inner square field of the indicator shows white, there is no excess temperature, then remove the temperature indicator.

- If there is coloration of the indicator (inner field black) proceed according to IQ document RXD-000.038.01... .

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch off the POWERMOBIL and wait approx. 3 minutes so that the high voltages on the I.I. minivoltage supply decay.

Dismantling

⚠CAUTION

Risk of injury!
Noncompliance can lead to light or medium injuries and/or property damage.

The C-arm cover contains counterbalance weights and weighs > 10 kg.
Hold the covers firmly when removing / installing them.

Before loosening the C-arm cover, move the C-arm into its middle orbital position.
After loosening the C-arm cover, do not move the C-arm into its orbital end positions (I.I. in the orbital end position).

VIDEOMED DC

- Move the I.I. into the service position (see Chapter 1 "I.I. service position").
- Remove the VIDEOMED DC and place it on a dustfree surface.
- Cover it to prevent contamination (see Chapter 6 "VIDEOMED DC").

I.I. minivoltage supply

- Remove the I.I. minivoltage supply and lay down on a suitable surface (control unit and high-voltage power supply).
- See Chapter 6 "Replacing the I.I. minivoltage supply".
- Dissipate any residual charge in the cables by shorting them to ground.
- Remove the O-ring and the cap nut from the anode cable.
- Remove the plug for the cassette contact.
- Disconnect all cables (protective wire, cable to VIDEOMED DC etc....) from the I.I.
- At the same time remove the cable ties or the cable clips.
- Draw all the cables inside the C-arm.

I.I. and Compact optics

NOTE	**When removing the Compact optics, make sure that no dust or dirt drops onto the output window of the I.I.** **Do not loosen the eccentric screws (2/Fig. 8) on the edge of the Compact optics!** **These screws are used to center the Compact optics to the I.I. output screen.**

- Firmly grasp the I.I. and swivel the C-arm:
  - I.I. below - POWERPHOS above.
- Place the I.I. carefully on the C-arm flange.
- Remove both threaded bolts from the I.I. housing.
- Lift the I.I. up out from the C-arm, turn it around and place it on a suitable surface (I.I. is standing on the grid.)
- Remove the clips for attaching the plugs and cable guide from the I.I.
- Remove the Compact optics and place them on a dustfree surface.
- Reattach the Compact optics and clips to the new I.I.
- If the "MODULARIS" is present, remove the centering disk (above the grid).
- Remove the grid. Unsolder the wires for the cassette contact.

Installation

Compact optics

NOTE	**When installing the Compact optics and the VIDEOMED DC, make sure that no dust drops on the output window of the I.I. or on the Compact optics.**

- Reattach the Compact optics to the new I.I.
- When doing this, guide the anode wire through the recess in the optics.
- The camera optics must lie against the eccentric screws.
- Reinstall the O-ring and the cap nut for the anode cable.
- The cable length should be 70 mm from the beginning of the white wire to the cap nut.
- Reattach the clips for attaching the plug and the cable guide to the I.I.

Image intensifier

- Set the I.I. back on the C-arm flange. The labels should face the C-arm.
- Turn the fastening bolts back in the I.I. threaded holes at least 5 turns.
- Hold the I.I. firmly and swivel the C-arm: I.I. above, POWERPHOS below.
- Carefully lower the I.I. into the service position.

I.I. minivoltage supply

- Reinstall the high-voltage power supply of the I.I. minivoltage supply.
- Reconnect the control unit but do not tighten the screws yet.
- Route the cables to the high-voltage power supply and the control unit and secure them with cable ties or cable clips.

VIDEOMED DC

- Turn the camera rotation of the Compact optics into 0° position (slowly!) (see also Chapter 6 "Replacing the VIDEOMED DC").
- Connect an ohmmeter to the potentiometer for camera rotation, point 2 and 3.
  There should be a resistance value of 5000 ohms ± 40 ohms at 0°. See also notes on page 6-13.
- Place the VIDEOMED DC in the 0° position on the Compact optics and clamp it securely.

Checks and adjustments

- Check and adjust the electrode voltages of the I.I. according to test protocol of the I.I.
- Check the resolution, if necessary adjust the optical sharpness of the Compact optics. Compact
- Use the IQ quick test, Chapter "Resolution for evaluating the optical sharpness" for this purpose.
- Check and if necessary adjust the dose rate.
- Check that the camera optics are centered onto the I.I. output screen and if necessary adjust them. (Refer also to Chapter 6 "Replacing the Compact optics", paragraph "Checking the centering of the camera optics to the I.I. output screen" and "Centering the Compact optics to the I.I. output screen").
- Check the camera rotation and if necessary adjust it (range of rotation $\pm$ 220°).

Concluding work

- Reinstall the I.I. on the C-arm flange (see Chapter 1 "I.I. service position").
- Check the collimator display on the monitor and adjust it if necessary.
- Perform the IQ quick test.
- If the "MODULARIS" system is present, fit the centering disk back on the grid and check the isocenter.
- Perform the country-specific acceptances (§16 Partial acceptance test, DHHS,...).

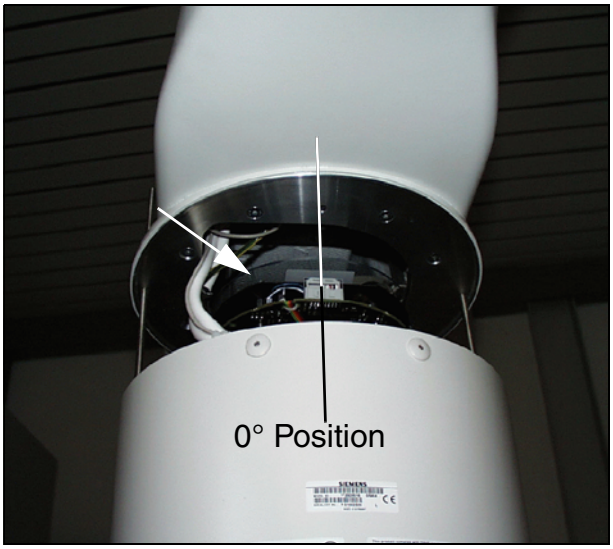


Fig. 3

Replacing the VIDEOMED DC

⚠WARNING	**Risk of injuries on mechanical parts!** **If not observed, slight to medium injuries, especially to the hands, can occur.** **Observe the notes concerning the C-arm carbon fiber structure.**
NOTE	**When removing or installing the VIDEOMED DC, make sure that there are no dust or dirt particles on the optics.**

- Move the I.I. into the service position (see Chapter 1).
- Remove the cable ties on the VIDEOMED DC board (see arrow/ Fig. 3).
- Loosen the plug connection between VIDEOMED DC and the Compact optics.
- Unlock the plug of the cable drum and pull it out.
- Remove the locking screw of the VIDEOMED DC.
- Remove the VIDEOMED DC.

Camera rotation 0° position

- Connect an ohmmeter to the actual value potentiometer of the Compact optics at point 2 and 3.

NOTE

If the numbering of the connections on the actual value potentiometer is not legible, these can be determined with the ohmmeter.

Prerequisite:

- **All connection cables from the camera optics to board D1 are plugged in.**
- **Connect a wire of the ohmmeter to the housing or protective ground wire.**
- **With the 2nd wire of the ohmmeter determine the ground connection of the actual value potentiometer:**
  - Measured value: < 20 ohms; = Potentiometer Pin 3.
- **Turn the Compact optics on the clamping ring approximately into the mechanical mid position (slowly!).**
- **With the 2nd wire of the ohmmeter determine the middle connec-tion of the potentiometer:**
  - Measured value ~3000 to ~7000 ohms, according to accuracy of the mid position; = Potentiometer Pin 2.
- **It is still possible to measure at the 3rd connection of the potentiometer as a check:**
  - Measured value: 10000 ohms ± 5 %; = Potentiometer Pin 1.
- **Then connect the measuring wires of the ohmmeter to the potentiometer Pin 2 and Pin 3.**

- Turn the Compact optics on the clamping ring (slowly!) until the ohmmeter indicates 5000 ohms ± 40 ohms (0° position). Do not adjust the camera rotation any more.
- Set and clamp the new VIDEOMED DC in the 0° position. The center of the plug is exactly in the center of the I.I. housing in the 0° position (see Fig. 3).
- Plug back the plug of the cable drum.
- Plug back the connection between VIDEOMED DC and Compact optics and fix with cable ties. Take care that the cable or the cable tie do not project beyond the edge of the board and lie in the recess of the VIDEOMED DC board.
- Still leave the I.I. in the service position.

Checks and adjustments

- Switch on the system and turn the camera rotation from + 220° to -220°.
  In this case the cable of the cable drum must permit the complete rotation range and must not drop laterally out from the cable drum.
- Mount the I.I. to the C-arm again.
- Check the camera rotation and adjust if necessary. It should be possible to turn the camera 220° + 3° or -220° -3° (check by reference to the indicator).

- Check and if necessary readjust the dose rate.
- Perform the IQ quick test. Firstly check the resolution. If necessary, readjust the optical sharpness on the Compact optics (see under "Settings - optical sharpness").
- If the "MODULARIS" system is present, check the isocenter.

I.I. minivoltage supply

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Before removing the high-voltage power supply the system must be switched off > 3 minutes so that the high voltages on the I.I. minivoltage supply decay.

⚠WARNING

Risk of injuries on mechanical parts!
If not observed, slight to medium injuries, especially to the hands, can occur.

Observe the notes concerning the C-arm carbon fiber structure.

⚠CAUTION

Risk of injury!
Noncompliance can lead to light or medium injuries and/or property damage.

The C-arm cover contains counterbalance weights and weighs > 10 kg.
Hold the covers firmly when installing or removing them.

Before loosening the C-arm cover, move the C-arm into its middle orbital position.
After loosening the C-arm cover, do not move the C-arm into its orbital end positions (I.I. in orbital end position).

NOTE

Rotate the camera into the 0° position prior to starting work to avoid having to readjust the camera rotation.

NOTE

The cathode wire of the I.I. (black wire connected to plug CON1.8 on the control unit) is sometimes very short.

The cathode wire can be extended for easier access to the test points and potentiometer on the control unit. To extend the wire, split the wire and strip off the insulation from the wire ends.

Place 2 pieces of shrink tubing of suitable diameter over the wire ends. Solder an approx. 25 cm wire of 0.75 mm².
Insulate the wire ends with shrink tubing.

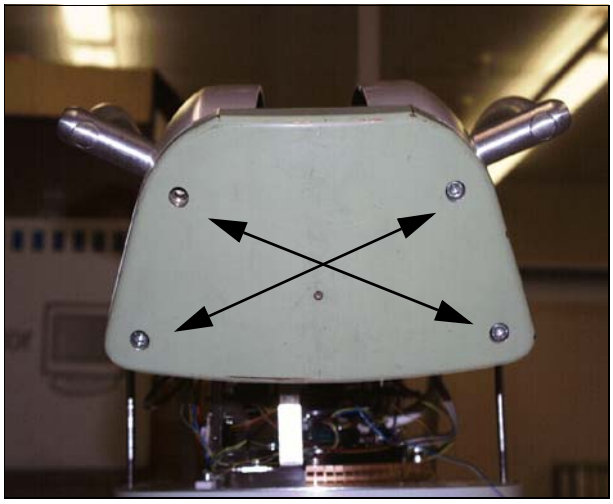


Fig. 4

Fig. 5

Fig. 6

- Remove the cover on the front of the C-arm by removing the screws (I.I. side, see Fig. 4).
- Move the I.I. into the service position (see Chapter 1 "I.I. service position").
- Remove both attachment screws for the control unit in the I.I. flange of the C-arm (see arrow/ Fig. 5).
- Carefully remove the control unit from the C-arm and disconnect all plugs.
- Disconnect the protective ground wire connection.
- Remove the VIDEOMED DC camera from the I.I.
- See "Replacing board / Replacing components VIDEOMED DC".
- Remove both attachment screws for the high-voltage power supply from the I.I. flange of the C-arm (Fig. 6).
- Remove the high-voltage power supply from the C-arm.

- Disconnect all the plugs. Dissipate any residual charge in the cables by shorting them to ground.
- Install the new high-voltage power supply.
- Connect the control unit but tighten the screws only after adjustment (see "Adjusting the I.I. minivoltage supply").
- Refit and clamp the VIDEOMED DC.

Adjusting the I.I. minivoltage supply

⚠CAUTION

Risk of injury!
Noncompliance can lead to light or medium injuries and or property damage.

The C-arm cover contains counterbalance weights and weighs > 10 kg.

Hold the covers firmly when installing or removing them.

Before loosening the C-arm cover, move the C-arm into its middle orbital position.

After loosening the C-arm cover, do not move the C-arm into its orbital end position (I.I. in orbital end position).

NOTE

The cathode wire of the I.I. (black wire connected to plug CON1.8 on the control unit) is sometimes very short.

The cathode wire can be extended for easier access to the test points and potentiometer on the control unit. To extend the wire, split the wire and strip off the insulation from the wire ends.

Place 2 pieces of shrink tubing of suitable diameter over the wire ends. Solder an approx. 25 cm wire of 0.75 mm².
Insulate the wire ends with shrink tubing.

- Hold the covers firmly when removing or installing them!
- Remove the cover from the front of the C-arm by removing the screws (I.I. side).
- Move the I.I. into the service position (see Section "I.I. service position").
- Loosen the two fastening screws of the control unit on the I.I. flange of the C-arm.
- Carefully remove the control unit from the C-arm.
- Adjust the voltages E1 (test point UE1), E2 (test point UE2), E3 (test point UI15) and anode (test point UI30) according to the I.I. protocol, see also wiring diagram.
- Reinstall the control unit in the C-arm.
- Reinstall the cover of the C-arm.
- Perform the IQ quick test.
- Check the function and setting of the collimator and adjust if necessary.
- Check the function and setting of the monitor collimator display, adjust if necessary.

- Check the 0° position of the camera rotation
  (see Chapter "Replacing the VIDEOMED DC, 0° position").
- Check the camera rotation function.
- Finally reinstall the I.I. on the C-arm (see Chapter 1 "I.I. service position").
- Check the functioning of the camera rotation (range of rotation $\pm$ 220°).

Fig. 7

Replacing the Compact optics

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch off the POWERMOBIL and wait approx. 3 minutes so that the high voltages on the I.I. minivoltage supply decay.

⚠WARNING

Risk of injuries on mechanical parts!
If not observed, slight to medium injuries, especially to the hands, can occur.

Observe the notes concerning the C-arm carbon fiber structure.

Dismantling

⚠CAUTION

Risk of injury!
Noncompliance can lead to light or medium injuries and or property damage.

The C-arm cover contains counterbalance weights and weighs > 10 kg.
Hold the covers firmly when installing or removing them.

Before loosening the C-arm cover move the C-arm into its middle orbital position.
After loosening the C-arm cover, do not move the C-arm into its orbital end positions (I.I. or POWERPHOS in the orbital end position).

Camera optics

- Bring the I.I. into service position (see Chapter 1 "I.I. service position").
- Turn the camera into the 0° position (see Fig. 7).

VIDEOMED DC

- Cut open the cable tie (see arrow/Fig. 7) and disconnect the plugs.
- Remove plug X1 on the Compact optics.
- Remove the VIDEOMED DC and place it down protected from dust (see also "Replacing the VIDEOMED DC").

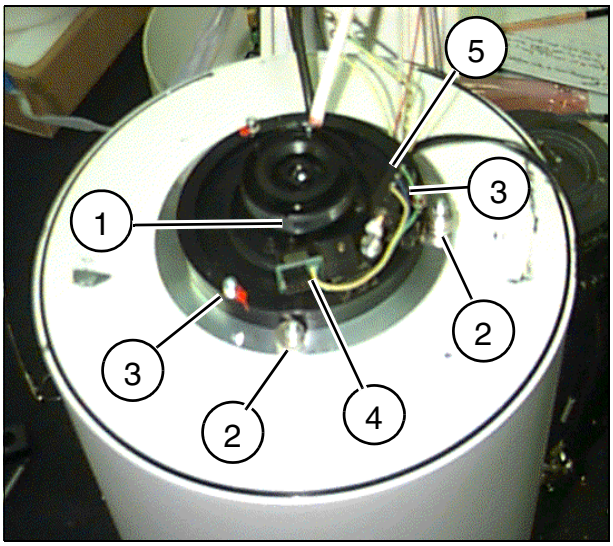


Fig. 8

High-voltage power supply of the I.I. minivoltage supply

- Remove the high-voltage power supply of the I.I. minivoltage supply. Loosen the two fastening screws on the C-arm flange (see arrows/ Fig. 7).
- Disconnect the anode cable from the high-voltage power supply and withdraw the O-ring and the cap nut from the cable.

Compact optics

NOTE	**When removing the Compact optics make sure that no dust or dirt drops on the output window of the I.I. Do not loosen the eccentric screws (2/Fig. 8) on the edge of the Compact optics! These screws are used to center the Compact optics to the I.I. output screen.**

- Loosen the fastening screws of the Compact optics. If necessary, also remove the clip for the plugs / cable routing and remove the Compact optics.

Installation

NOTE	**When installing the Compact optics make sure that no dust or dirt drops on the output window of the I.I. or on the Compact optics.**

Optics

- Reinsert the rubber gasket between the Compact optics and the I.I. housing.
- Reinstall the new Compact optics. Reattach the clip for the plugs / cable routing.
- To do so, run the anode cable through the recess in the Compact optics.
- The Compact optics must lie against the eccentric screws.

High-voltage power supply

- Reinstall the O-ring and the cap nut on the anode cable. The cable length from the beginning of the white wire to the cap nut should be 70 mm.
- Reconnect the high-voltage cable.
- Reinstall the high-voltage power supply.
- Reattach the cables for the high-voltage power supply with cable ties.

Camera rotation 0° position

- Rotate the camera rotation of the Compact optics into 0° position.
- Connect an ohmmeter to the potentiometer for camera rotation, point 2 and 3.
- In the 0° position, the resistance must be 5000 ohms ± 40 ohms.
- If necessary, hold the Compact optics by the clamping ring for the VIDEOMED DC and slowly rotate them.

VIDEOMED DC

- Place and clamp the Videomed DC in the 0° position on the Compact optics (see also Fig. 7).
- Plug back the connection cable (see arrow/ Fig. 7) and fasten the cable with a cable tie in the recess of the VIDEOMED DC board. When doing this make sure that the cable tie and the cable do not project beyond the edge of the board.
- Reconnect plug X1 of the VIDEOMED DC cable drum.

Other cables

- Reconnect all cables and plugs and fasten them with cable ties.

Settings

Optical sharpness

- The I.I. remains in the service position.

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Observe radiation protection! Wear a lead apron!**

- Fasten the sharpness test to the I.I. input.
- Attach 2.1 mm Cu + 60 mm Al to the radiation exit of the POWERPHOS.
- Use the IQ quick test, Chapter "Resolution for evaluating the optical sharpness".

- Check the optical sharpness and if necessary adjust on the wider ring of the optics. If necessary, loosen the long screw on the upper narrow ring with a suitable hexagonal key.

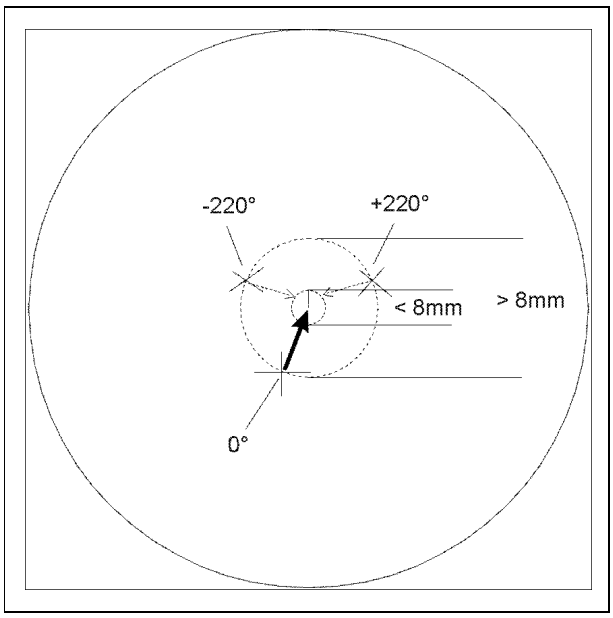


Fig. 9

Checking the camera optics centering at the I.I. output screen

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Observe radiation protection! Wear a lead apron!

- Mark the center of the image intensifier at the I.I. input accurately and fasten a small washer ≤ 3.2 mm by means of adhesive tape. Select full format.
- Move the camera rotation into 0° position.
- Switch on fluoroscopy briefly.
- Mark the center of the washer or of the lead cross on the monitor (see Fig. 9).
- Turn the camera into the -220° position.
- Mark the center again on the monitor (see Fig. 9).
- Turn the camera into the +220° position.
- Mark the center again on the monitor (see Fig. 9).
- Place an 8 mm washer over the three markings. All three markings must be located within the 8 mm diameter of the washer.
  An 8 mm washer has a somewhat larger inside diameter of 8.4 mm, therefore the markings must clearly lie within the inside diameter and should not touch the edge of the washer.
- With a diameter e 8 mm, the following centering adjustment does not have to be performed. Continue with "Checks and adjustments".
- If the markings go beyond > 8 mm proceed according to the following description "Centering the camera optics on the I.I. output screen".

Centering the camera optics to the I.I. output screen

⚠WARNING	**X-ray radiation!** **See Chapter 1, Safety Information.** **Observe radiation protection! Wear a lead apron!**

Prerequisite: The marking of the +220°, -220° and 0° positions was already performed as previously described.

- Rotate the camera optics back to the 0° position.
- Slightly loosen the three fastening screws of the camera optics slightly.
- Slightly loosen both eccentric screws adjacent to the camera optics.
- Move the camera optics towards the center, between the two +220° and -220° markings (see also Fig. 9).

- Switch on fluoroscopy briefly and evaluate the position shift on the monitor.
  Due to the ratio of the I.I. input screen diameter to the I.I. output screen diameter, a shift of the camera optics by 0.1 mm corresponds to a position shift of the washer displayed on the monitor of more than 1.7 mm (23 cm I.I.).
- Fasten the camera optics again.
- Wipe off the three markings on the monitor.

- Switch fluoroscopy on briefly and mark the new 0° position.
- Turn the camera into the -220° position.
- Mark the center again on the monitor.
- Turn the camera into the + 220° position.
- Mark the center again on the monitor.
- Place an 8 mm washer over the three markings. All three markings must be located within the 8 mm diameter of the washer. An 8 mm washer has a somewhat larger inside diameter of 8.4 mm, therefore the markings must clearly lie within the inside diameter and should not touch the edge of the washer.
- If necessary, repeat the adjustment until the three markings are within the 8 mm diameter.
- Screw the camera optics tight.
- Set and tighten the eccentric screws against the camera optics.

Checks and adjustments

- Reinstall the I.I. on the C-arm.
- Check and if necessary readjust the camera rotation (range of rotation $\pm$ 220°).
- Check and if necessary readjust the setting of the X-Iris.
- Check and if necessary readjust the collimator displays on the monitor.
- Check and if necessary readjust the dose rate.
- Perform the IQ quick test.
- If a "MODULARIS" system is present check the isocenter.

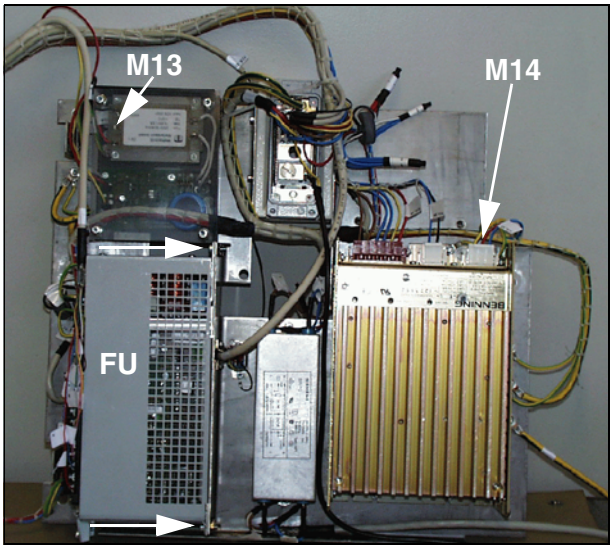


Fig. 10

Basic unit control panel

- Disconnect the plugs for the control panel from board D1.
- Remove the cable clip of the cable to the control panel.
- Remove the Allen screws on the fastening ring (swivel joint of the control panel).
- Replace the control panel.
- Reinstall the fastening ring.
- Reconnect the cable.
- Reattach the cable clip.
- Perform a functional test of the control panel.

Frequency converter FU (vertical lift)

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off.

- Remove the cover over the plug board / terminal board of the frequency converter.
- Disconnect the power plug.
- Remove the cable clips and cable ties at and in front of the frequency converter.
- Disconnect all the cables on the frequency converter.
- Remove the jumper FU.PTC - FU.UKZ on the new frequency converter. The jumper is not required.
- Replace the frequency converter after removing the Allen screws (see arrow/ Fig. 10).
- Reconnect all the cables.

- Reconnect the power plug.
- Secure the cables again with cable ties.
- Reattach the cables with the cable clips.
- Perform functional test of the lifting column movement.

Power supply M14, +5 V / +15 V / -15 V

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off.

- Replace the power supply.
- Check the power supply voltages and adjust if necessary (see Chapter 3 of these instructions "Checking the operating voltages").

Power supply M13, +13 V Videomed DC

⚠WARNING

Electrical voltage!
See Chapter 1, Safety Information.

Switch the system power supply off.

- Remove the plexiglas cover over the power supply. Remove the 4 Allen screws.
- Replace the power supply.
- Check the power supply voltages and adjust if necessary (see Chapter 3 of these instructions "Checking the operating voltages").

I.I. Laser targeting device

- The laser diodes can be replaced after removing the plastic bracket and unsoldering the wire.
- Adjust the laser diodes after replacement (see installation and setting instructions "I.I. Laser targeting device").

Replacing the MEMOSKOP Fast

Saving the parameters

NOTE	**If still possible, save the parameters of the MEMOSKOP Fast to a disk in order to save the programs of the customer's organ menu. If this is no longer possible try to read out and record the parameters in the MEMOSKOP Fast user setup. Otherwise you will have to inform the customer that the organ menus will contain default values again after the replacement and will require reprogramming according to the customer's request.**

Replacing the MEMOSKOP Fast

- Replace the MEMOSKOP Fast.
- The fastening screws are accessible from the underside of the memory.

Preparations

NOTE	**Installation of the Memoskop Fast service program: There is a "README.TXT" file on the service software disk. Please observe the technical instructions regarding Windows 95 operating system and settings of the serial interface of the service PC.**

- Connect the service PC to the serial interface of the POWERMOBIL.
- Start the MEMOSKOP service program.

Download

- Preparations: see page 6-23.

NOTE	**After selecting the button "Get from Memoskop", the software version of the MEMOSKOP Fast is displayed in the "Memoskop Software Version" line. Compare the MEMOSKOP disk - MEMOSKOP Fast memory software versions. Perform the download only if the MEMOSKOP Fast software version has a lower version number. Otherwise continue the installation with "Loading the parameters".**

- Insert the MEMOSKOP disk with the download file in drive A.
- Select the "Download" menu in the main menu. The download window is opened.
- Click "Select File for Download" and select the download file present on the disk.
- Click "Erase FLASHes" and wait until the "ready" message appears.
- Click "Download File" within the next 120 seconds.
- The download process lasts approx. 25 minutes.
- "Ready" is displayed after the successful download.
- Close the download window by clicking the "Back" button.

Loading the parameters

- Preparations: see page 6-23.
- Select the "File" "Load" menu.
- Select Load with technical Data and load the parameter set, stored on the parameter disk of the MEMOSKOP service program, into the service program.
- Click Put to MEMOSKOP, the transmission to the MEMOSKOP starts.

Loading the language file

- Preparations: see page 6-23.
- Select the "Language" menu.
- Insert the disk with the language files in drive A.
- Select the language that is appropriate for your country.
- Click "Send this Language to MEMOSKOP", the language file is transferred.

Programming the organ menus

NOTE	**If the parameters on the disk were successfully saved, the organ menu will be restored after the parameters are reloaded and do not need to be reprogrammed.**

- Program the parameters you recorded from the organ menus, on the keyboard or by means of MEMOSKOP service program.

Programming the MEMOSKOP serial number

- Call up the technical setup on the MEMOSKOP keyboard.
- Select "More selections" to display the extended menu.
- Select "Unit serial number".
- Enter and save the serial number of the MEMOSKOP Fast.

Programming the Licenses (Options)

NOTE	**With the help of the service PC, the available licenses can be read from the unit. See Service Software Help file Moreinfo. hlp, link "Information/Licenses/Version Information UNIT ID".**

- Program the options 5000/9984 images; Sub; DCM according to the available licenses.
- Call up the technical setup on the MEMOSKOP keyboard.
- Select "More selections" to display the extended menu.
- Select "Subtraction available" and program the value according to the License.
- Select "DCM available" and program he value according to the License.
- Select "More Selection" to display the extended menu.
- Select "Maximum image number" and program the value according to the License.
- Exit the technical setup.

Loading a LUT file (if present)

NOTE

It may be necessary to adapt the LUTs in the future for special examinations. The LUT file is supplied on an additional disk. Only if a LUT disk is already present at the system will it be necessary to transfer the file again after replacing the MEMOSKOP.

- Preparations: see above.
- Insert the disk with the LUT file in the drive A of the service PC.
- Click "LUT file..." and select the file.
- Click "Send LUT file...". The file will be transferred to the MEMOSKOP.

Concluding Tasks

- Perform the IQ quick test.

MULTISPOT 2000

Before installing the new MULTISPOT 2000, set the correct refresh rate.

50Hz refresh rate		60Hz refresh rate	
Jumper	Position	Jumper	Position
X4	b	X4	a
X5	open	X5	open
X6	b	X6	a
X7	b	X7	a
X8	b	X8	a
X9	b	X9	a
X10	b	X10	a
X11	b	X11	a

Tab. 1

- Disconnect the POWERMOBIL power plug from the power socket.
- Replace the MULTISPOT 2000 . The fastening screws of the MULTISPOT 2000 are accessible on the underside of the camera.
- Perform a camera function test after the replacement.
- Determine and program the exposure parameters of the MULTISPOT 2000 according to IQ quick test (see log book).
  Record the new exposure parameters in the IQ quick test instructions.

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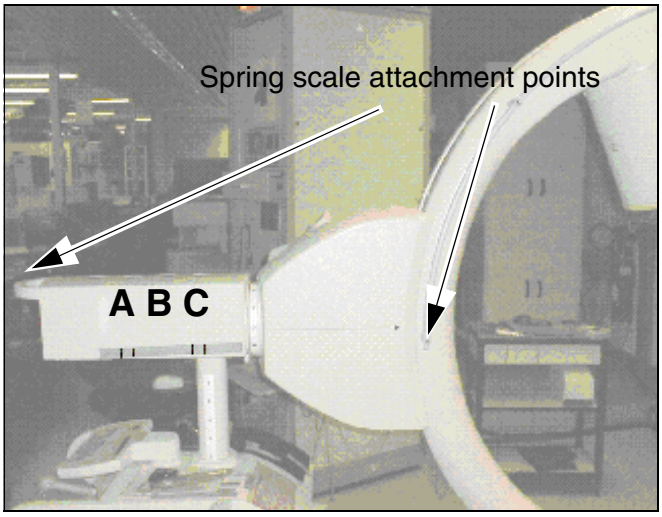

Fig. 1

Brake forces / brake torques

⚠WARNING

Risk of injuries on mechanical parts!
If not observed, slight to medium injuries, especially to the hands, can occur.

Observe the notes concerning the C-arm carbon fiber structure.

Measuring the horizontal movement forces

The attachment point for the spring scale is the end of the railing on the I.I. side and/or the handgrip of the horizontal carriage. Always pull along the movement direction at constant speed.

- ➪ The maximum force for moving the horizontal carriage constantly when the brakes are released is 115 N.
- ➪ When the brakes are applied the force must be $\geq$ 180 N .

Measurement A-C: Pull on the handgrip of the horizontal unit.
Test points after 30, 170 and 200 mm.

Measurement C-A: Pull on the railing on the I.I. side.
Test points after 30, 170 and 200 mm.

Measuring the horizontal swivel forces

- ➪ Torque when the brakes are released max. 55 Nm.
- ➪ Torque when the brakes are applied > 100 Nm.

C-arm vertical, the attachment point is the end of the railing on the I.I. side (see Fig. 1).
The distance from the fulcrum / axis to the attachment point is 60 cm.
Maximum force to be applied = 55 Nm / 0.6 m = 92 N.

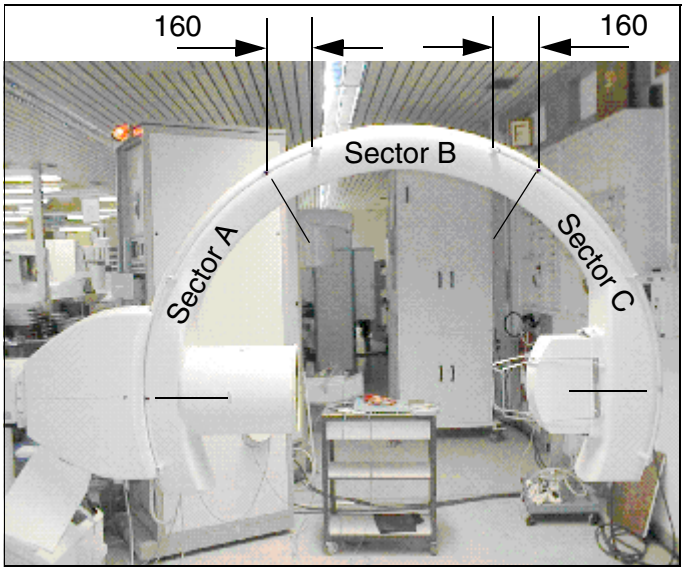

Fig. 2

Measuring the orbital movement forces

The attachment point for the spring scale is the end of the railing on the I.I. side in sector B. Always pull along the C-arm at constant speed.

Movement when brakes are released

- ➪ C-arm in vertical position, the force used to move the C-arm constantly must not exceed 85 N.
- ➪ C-arm in horizontal position, the force used to move the C-arm constantly must not exceed 120 N.
- ➪ When brakes are applied, the force required for movement when the C-arm is in the vertical position is $\geq$ 85 Nm.

Measurement A-C: Start at 90° (I.I.), pull with spring scale to -90° (POWERPHOS).
The C-arm opening faces downward at the start of the measurement.

Measurement C-A: Start at -90° (POWERPHOS), pull with spring scale to 90° (I.I.).
The C-arm opening faces downward at the start of the measurement.

Measuring the angular movement forces

The attachment point for the measurement is the railing next to the I.I., where the C-arm has an orbital position of 0° and an angulation of 0°.

- ➪ When the brakes are released, the force required for movement is between 10 and 50 N.
- ➪ When the brakes are applied, the force required for movement must exceed 70 N in order to move the C-arm.

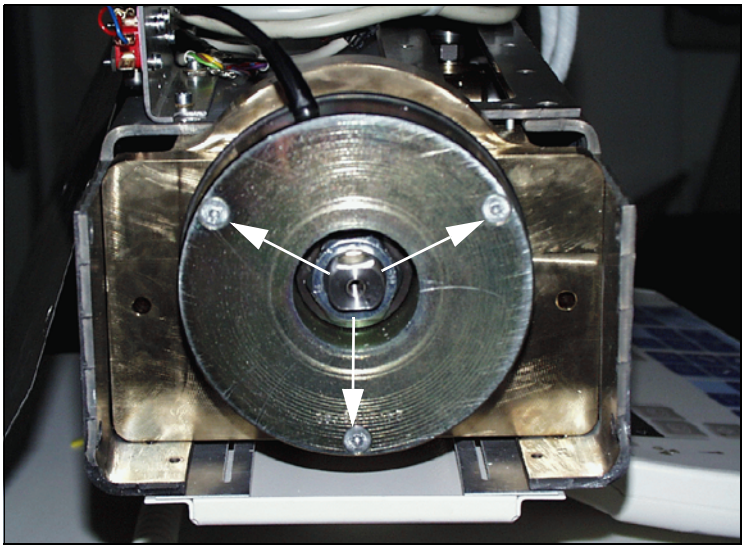

Fig. 3

Angulation brake magnet

⚠CAUTION	**Risk of burn!** **See Chapter 1, Safety Information.** **When the angulation brake is released, the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.**

- Remove the cover of the horizontal carriage (see Chapter 1 "Installing / removing the cover with brake controls on the horizontal carriage").
- Remove the back cover with the handle for the horizontal lift movement after removing the 4 countersunk screws. The angulation brake magnet is now visible.
- Remove the cover plate over the C-arm cable guide.
- Remove the 3 attachment screws and remove the brake magnet.

NOTE	**Remove both parts of the brake magnet!**

- Remove the plug connection for the brake magnet and insert the new brake magnet.
- Place the new brake magnet back on the shaft and attach it with the 3 screws.
- Reattach the cable with cable ties.
- Reattach the cover over the C-arm cable guide.
- Reinstall the cover. Make sure the protective conductor is connected properly.
- Perform a function test of the brake (see "Brake forces / Brake torques").
- A 30 mm wrench (hexagonal) is required for adjusting the brake.

Horizontal swivel brake

⚠CAUTION

Risk of burn!
See Chapter 1, Safety Information.

When the swivel brake is released, the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.

- The swivel brake replacement kit 56 44 955 includes the replacement instructions SPR2-230 841.02... Please use these instructions for performing the work steps.

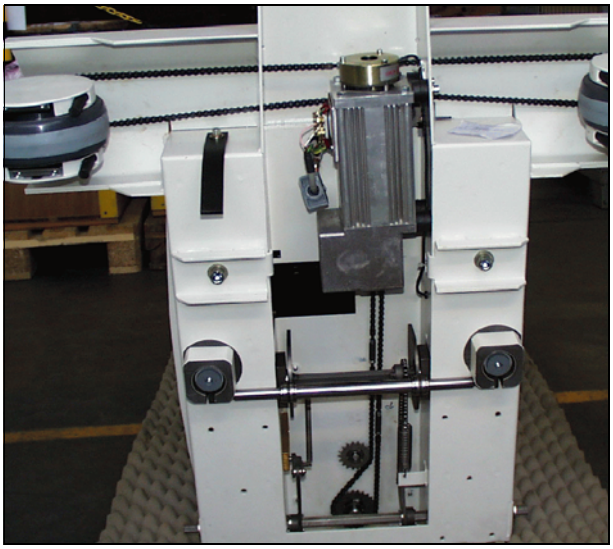

Fig. 4

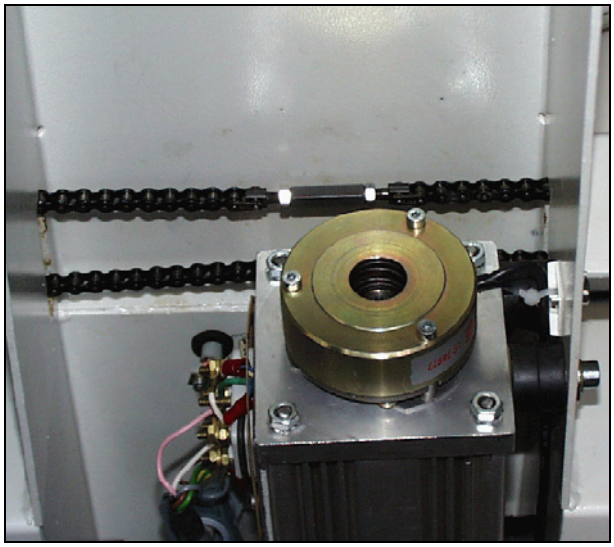

Fig. 5

Vertical lift brake

⚠CAUTION

Risk of burn!
See Chapter 1, Safety Information.

When the vertical lift brake is released (while lifting or lowering the vertical lift column) the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.

⚠CAUTION

Risk of injury!
Noncompliance can lead to light or medium injuries and/or property damage.

To replace the vertical lift brake, the POWERMOBIL must be placed on its side.

This requires 6 people. To avoid damage to the POWERMOBIL or the floor, use a suitable floor covering (e.g. woollen blankets or cartons).

- Remove the basic unit cover.
- Place the POWERMOBIL on its side.
- Remove plug D30.X8 and eject the contacts.
- Remove the 3 attachment screws for the vertical lift brake and replace the brake.
- Remove plug D30.X8.
- Eject the contacts from plug D30.X8.
- Route the wires of the new vertical lift brake to board D30 and insert the contacts in the plug housing.

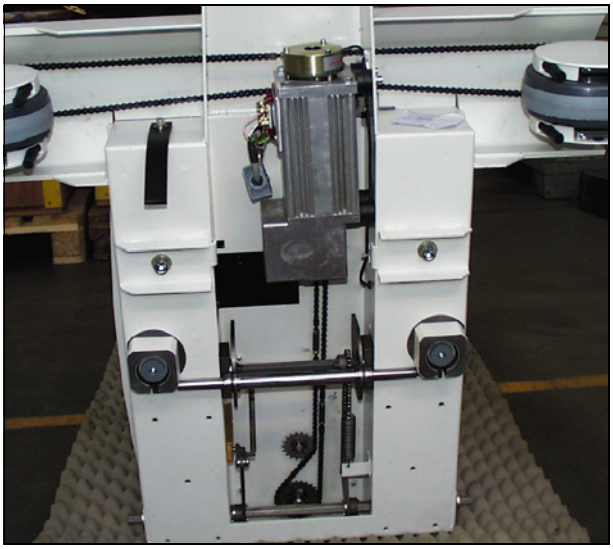

Fig. 6

Vertical lift motor

⚠CAUTION

Risk of burn!
See Chapter 1, Safety Information.

When the vertical lift brake is released (while lifting or lowering the vertical lift column) the brake magnet heats up. Be sure to switch off the power supply and let the brake magnet cool off before touching it.

⚠CAUTION

Risk of injury!
Noncompliance can lead to light or medium injuries and/or property damage.

To replace the vertical lift motor, the POWERMOBIL must be placed on its side.

This requires 6 people. To avoid damage to the POWERMOBIL or the floor, use a suitable floor covering (e.g. woollen blankets or cartons).

- Remove the vertical lift magnet from the vertical lift motor (3 screws).
- Remove the attachment screws for the vertical lift motor.
- Remove the vertical lift motor with the gears from the spindle.
- Disconnect the wires from the frequency converter FU.
- Route the wires of the new vertical lift motor to the frequency converter FU and connect them.
- Place the new motor on the spindle. Make sure the spindle is seated correctly in the gears.
- Attach the motor with the screws.

- Install the vertical lift magnet on the vertical lift motor.
- Return the POWERMOBIL to the upright position.
- Lubricate the spindle and the lifting column mounting.
- Check the vertical lift function. Also check that the vertical lift motor switches off at the end positions of the vertical lifting column (limit switches).

Vertical lift limit switches

- Replace the limit switches. Reconnect the wires.
- To adjust the limit switches, move the lifting column **slowly and carefully** until it is positioned just before the mechanical end stop.
- Adjust the respective limit switch and tighten the screws.
- Make sure the limit switch functions correctly.
- To do this, move back out of the end position.
- Then **slowly and carefully** move to the end position.
- The lifting column motor must switch off prior to reaching the end position and the lifting column must come to a full stop.
- Move the lifting column approximately 10 cm away from the end position.
- Now move the lifting column at full speed in the direction of the end position by pressing and holding the lifting column button.
- The lifting column motor must switch off prior to reaching the mechanical end stop and the lifting column must come to a full stop.

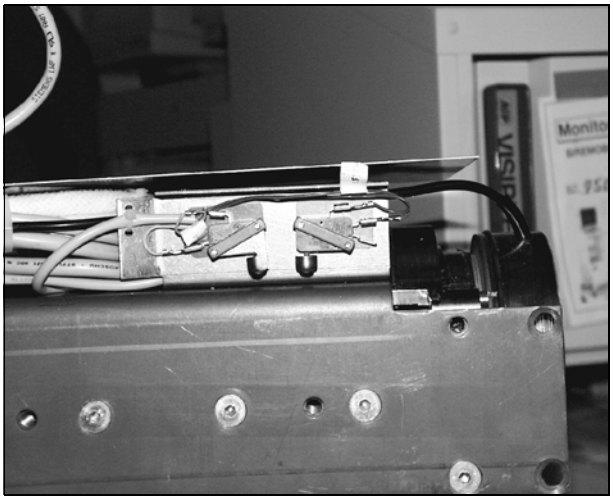

Fig. 7

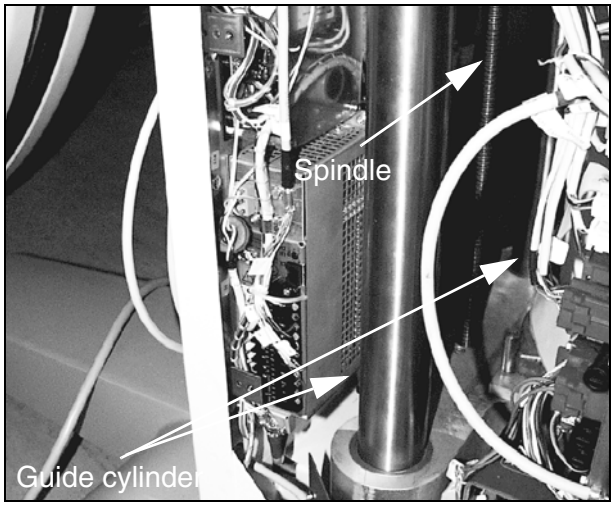

Fig. 8

Switches for blocking vertical lift (optional)

- The two switches can be replaced after removing the horizontal lift cover (see also Chapter 1).
  Adjustment: see the MODULARIS service instructions.

Lubricating the lifting column parts

- Lubricate the spindle of the lifting column and the mounting of the guide cylinder once annually. In the case of running noises, check the lifting column mechanism for damage.

Spindle

- Lubricate the spindle with approx. 10 - 20 ml of "Optimol, Optipit" special-purpose oil.
  In the case of running noises, check the lifting column mechanism for damage.

Guide cylinder

- Grease the guide cylinders with approximately 5 - 10 ml of special bearing grease "Slick Pac PTFE" .
- Then move the lifting column through the entire travel range twice to ensure that the grease is evenly distributed.

⚠WARNING

X-ray radiation!
See Chapter 1, Safety Information.

Observe radiation protection! Wear a lead apron!

NOTE

When measuring the tube current, the voltage divider current must be subtracted from the measured value. The voltage divider current depends upon the kV and is calculated according to Ohm's law. The voltage divider resistance is 400 MOhm.

- Switch the POWERMOBIL off.
- On board D21 set switch S3 to ON.
- Connect the mA measuring instrument to D21.X121 MAS+ and MAS-.

- Switch the POWERMOBIL on.
- The total current can be read off during radiation.
- Read the kV value which results while measuring the current.

The tube current can now be calculated:

$$\text{Tube current [mA]} = \text{total current [mA]} - \frac{\text{High voltage [kV]}}{\text{Volt. divider resistance[MOhm]}}$$

e.g.:

A total current of 5.275 mA is measured at 110 kV.

$$\text{Tube current [mA]} = 5.275\ \text{[mA]} - \frac{110\ \text{[kV]}}{400\ \text{[MOhm]}} = 5.275\ \text{[mA]} - 0.275\ \text{[mA]} = \underline{5.0\ \text{[mA]}}$$

- After the measurement set the switch S3 on D21 back to OFF.

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Chap. all	New Prontnumber

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